

ISaGRAF® Embedded Controllers

WinPAC-8147/8447/8847

WinPAC-8146/8446/8846

iPAC-8447/8847

μPAC-7186EG

By Chun Tsai

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Data Sheet : www.icpdas.com > ISaGRAF SoftLogic PAC > Data Sheet

FAQ : www.icpdas.com > FAQ > Software > ISaGRAF

Products

- μPAC-7186 & iPAC-8000
- WinPAC-8000
- I-7000 & RU-87Pn RS-485 Remote I/O
- Modbus Remote I/O
- Ethernet I/O: I-8KE4/8KE8
- FRnet IO
- Wireless Radio Modem
- Touch HMI
- Converter (RS-232/485/422)
- PC-Based I/O boards
- Industrial Ethernet switch
- Signal conditional module



Ordering Information : ISaGRAF

- ISaGRAF-256-E: ISaGRAF Ver. 3, 256 Tags, English Manual
- ISaGRAF-256-C: ISaGRAF Ver. 3, 256 Tags, 中文手冊
- For μ PAC-7186EG, iPAC-8447/8847 & WinPAC-8xx7/8xx6
- 256 Tags (ISaGRAF Ver. 3) is enough for programming the above controllers (Using Remote IO are not count into tags)
- ISaGRAF demo version can be download at , one month only.
<http://www.isagraf.com/> Goto “Downloads” - “ISaGRAF 3.55 English”



Ordering Information : WinPAC-8x47

- **WP-8147:**
ISaGRAF WinCE 5.0 PAC, 1 I/O Slot, RS-232 x 1, RS-485 x 1, Ethernet x 2 , USB x 1, VGA port
- **WP-8447:**
ISaGRAF WinCE 5.0 PAC, 4 I/O Slot, RS-232 x 2, RS-485 x 1, RS-232/485 x 1, Ethernet x 2 , USB x 1, VGA port
- **WP-8847:**
ISaGRAF WinCE 5.0 PAC, 8 I/O Slot, RS-232 x 2, RS-485 x 1, RS-232/485 x 1, Ethernet x 2 , USB x 1, VGA port



Ordering Information : WP-8x46

Hardware is the same as WP-8x47

- WP-8**1**46-CE300D : Indusoft + ISaGRAF PAC, **300** Tags, **1** I/O Slot
- WP-8**1**46-CE1500D: Indusoft + ISaGRAF PAC, **1500** Tags, **1** I/O Slot
- WP-8**4**46-CE300D : Indusoft + ISaGRAF PAC, **300** Tags, **4** I/O Slot
- WP-8**4**46-CE1500D: Indusoft + ISaGRAF PAC, **1500** Tags, **4** I/O Slot
- WP-8**8**46-CE300D : Indusoft + ISaGRAF PAC, **300** Tags, **8** I/O Slot
- WP-8**8**46-CE1500D: Indusoft + ISaGRAF PAC, **1500** Tags, **8** I/O Slot



Ordering Information : iP-8x47

- **iP-8447:**
ISaGRAF MiniOS Controller, **4** I/O Slot, COM1:RS-232, COM2: RS-485, COM3:RS323/485, COM4:RS-232, 2 Ethernet
- **iP-8847:**
ISaGRAF MiniOS Controller, **8** I/O Slot, COM1:RS-232, COM2: RS-485, COM3:RS323/485, COM4:RS-232, 2 Ethernet

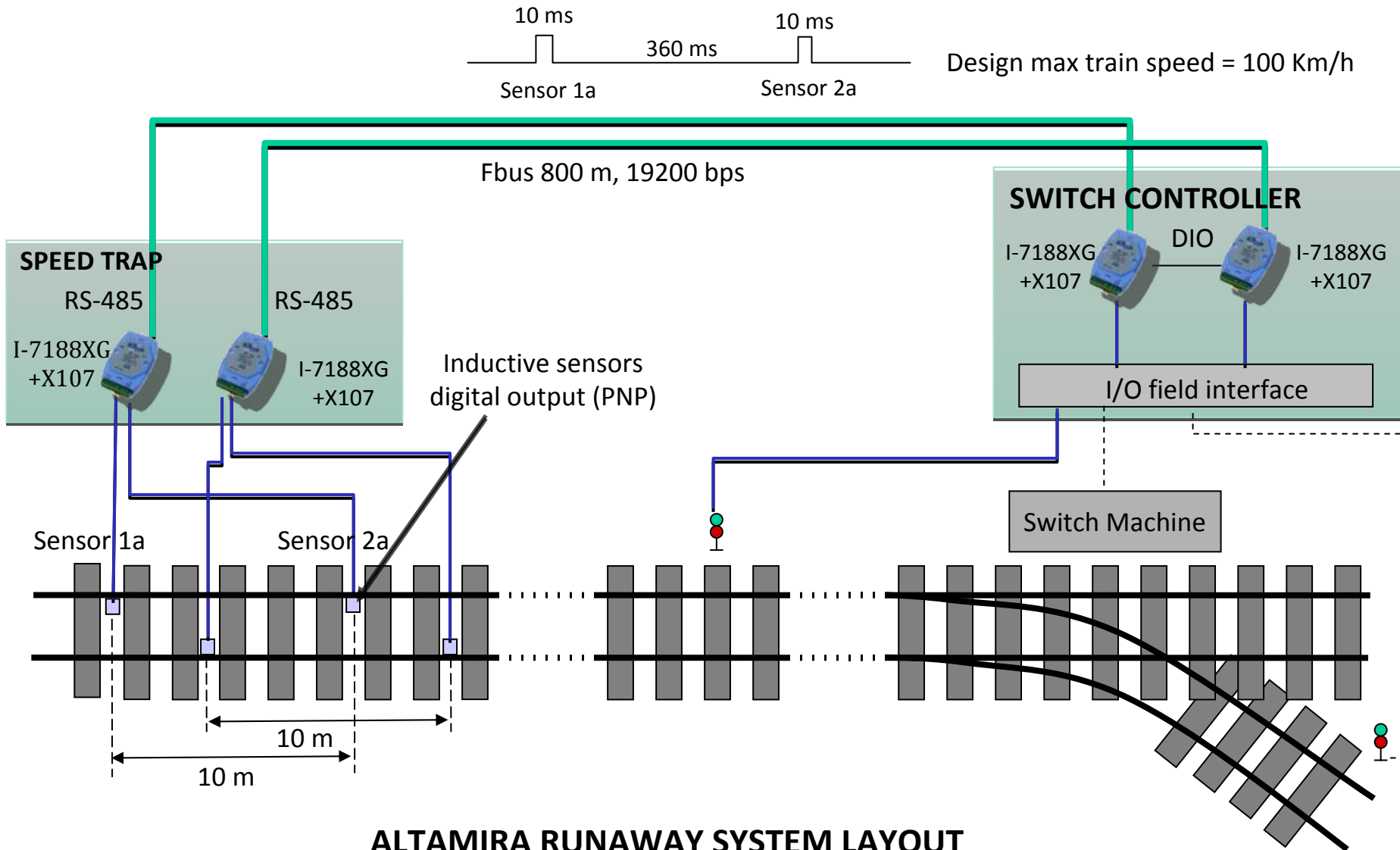


Ordering Information : μ PAC-7186EG

- μ PAC-7186EG: ISaGRAF MiniOS Controller, COM1:RS-232, COM2:RS-485, Ethernet x 1
- μ PAC-7186EGD: ISaGRAF MiniOS Controller, COM1:RS-232, COM2:RS-485, Ethernet x 1, 7-Seg. LED Display
- I-7188XG: ISaGRAF Controller, COM1:RS-232/485, COM2:RS-485 (40MHz, slower than μ PAC-7186EG / iP-8xx7)
- I-7188XGD: ISaGRAF Controller, COM1:RS-232/485, COM2:RS-485, 7-Seg. LED Display (40MHz, slower than μ PAC-7186EG / iP-8xx7)
- I-7188XG normal is blue color, name plus “-G” will be gray color



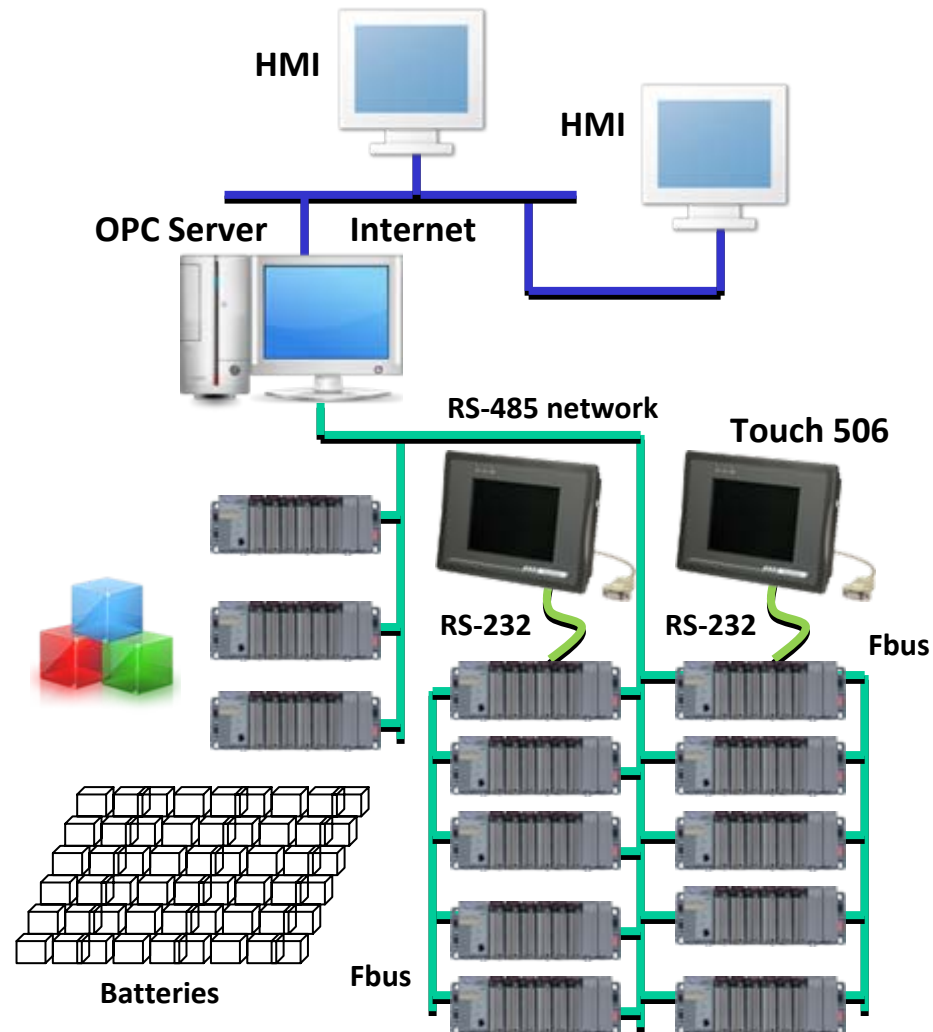
Runaway Application



ALTAMIRA RUNAWAY SYSTEM LAYOUT

Application Story Of ISaGRAF Embedded Controller Battery DAS

- 480 batteries , some power & security equipment of a telecom company
- 40 Ch. (10 pcs. I-87013) temperature , 480 Ch. (60 pcs I-8017H) voltage & about 50 DI signals to be measured
- All measured data are gathered by 13 I-8817.
- An “OPC server” running under windows 2000 requests all data from these 13 I-8817 through the RS-485 Modbus network and this “OPC server” can be connected by some remote HMI software (Iconics).
- Battery temperature & voltage are sent to two I-8817 through Fbus (controller to controller data exchange).
- Two touch monitors (Touch 506) are settled beside these two I-8817 to read out temperature & voltage through the RS-232 Modbus.



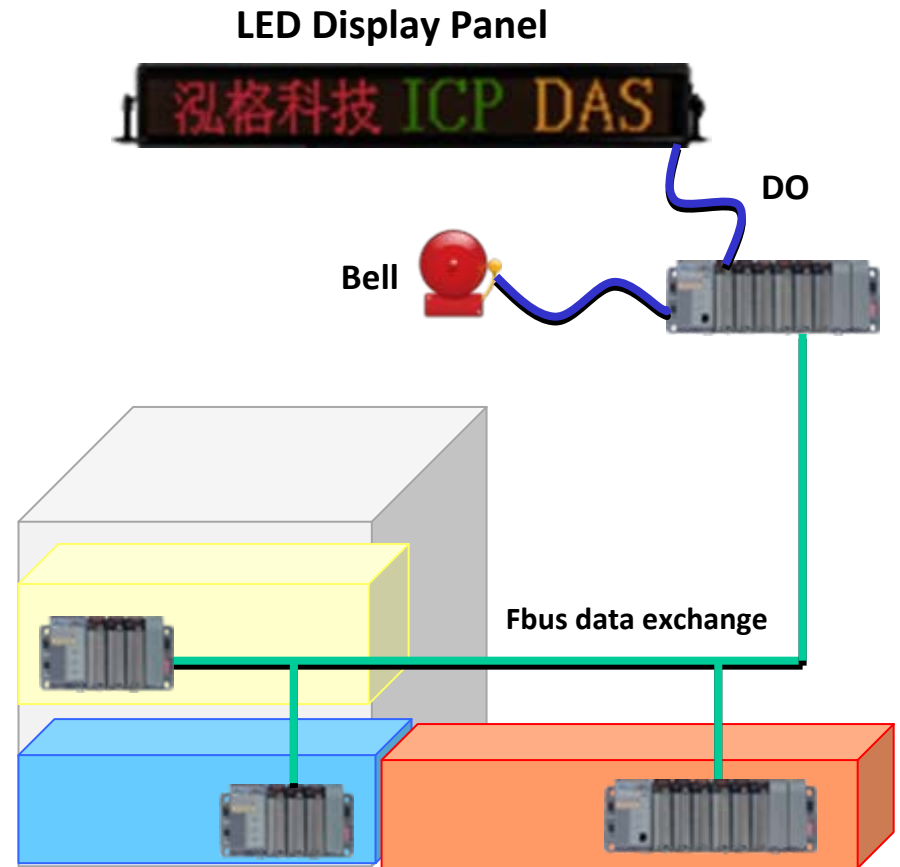
Car Testing

I-8817 + I-8000 I/O boards



Application Story Of ISaGRAF Embedded Controller Alarm System

- Alarm system of manufacture facility of Merk Display Tech. Ltd.
- No PC & Touch monitor.
- About 100 DI (9 pcs. I-8051) signals are collected from the facilities.
- About 110 DO Ch. (7 pcs. I-8056) to control the LEDs on the display panel
- One I-8817 & two I-8417 are used to acquire all DI signals and sent to one another I-8817 to display and ring.



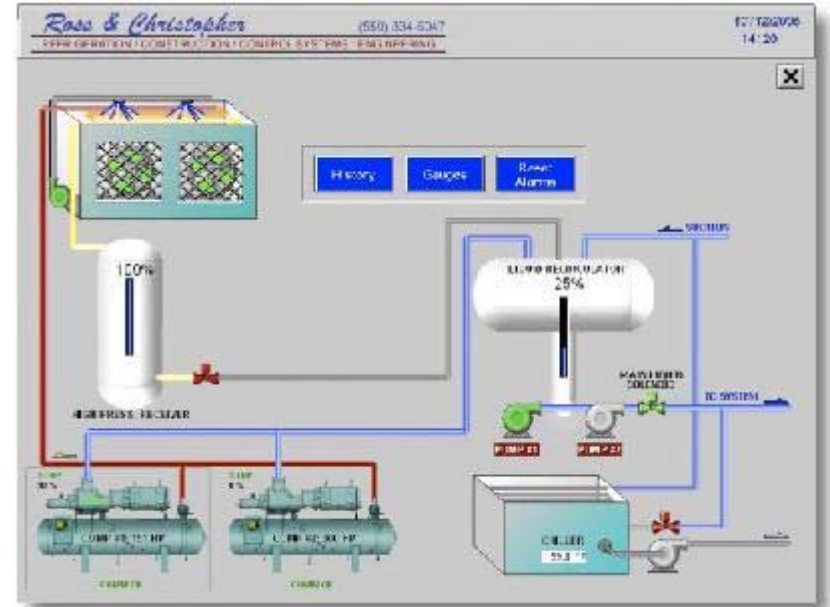
InduSoft For Cooler Control

Ross & Christopher, California

ISaGRAF + InduSoft AP

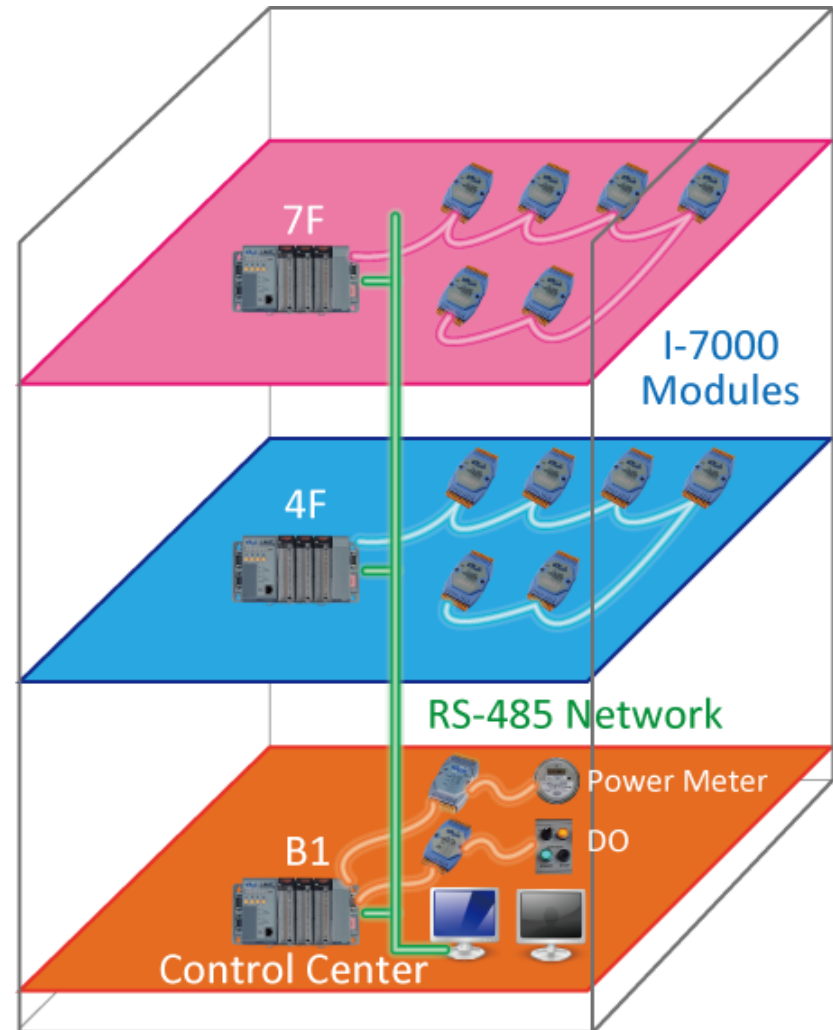
Some W-8736 + I-87K & I-7000 Remote IO

Remote Monitoring via Internet (InduSoft provide Web Thin Client)

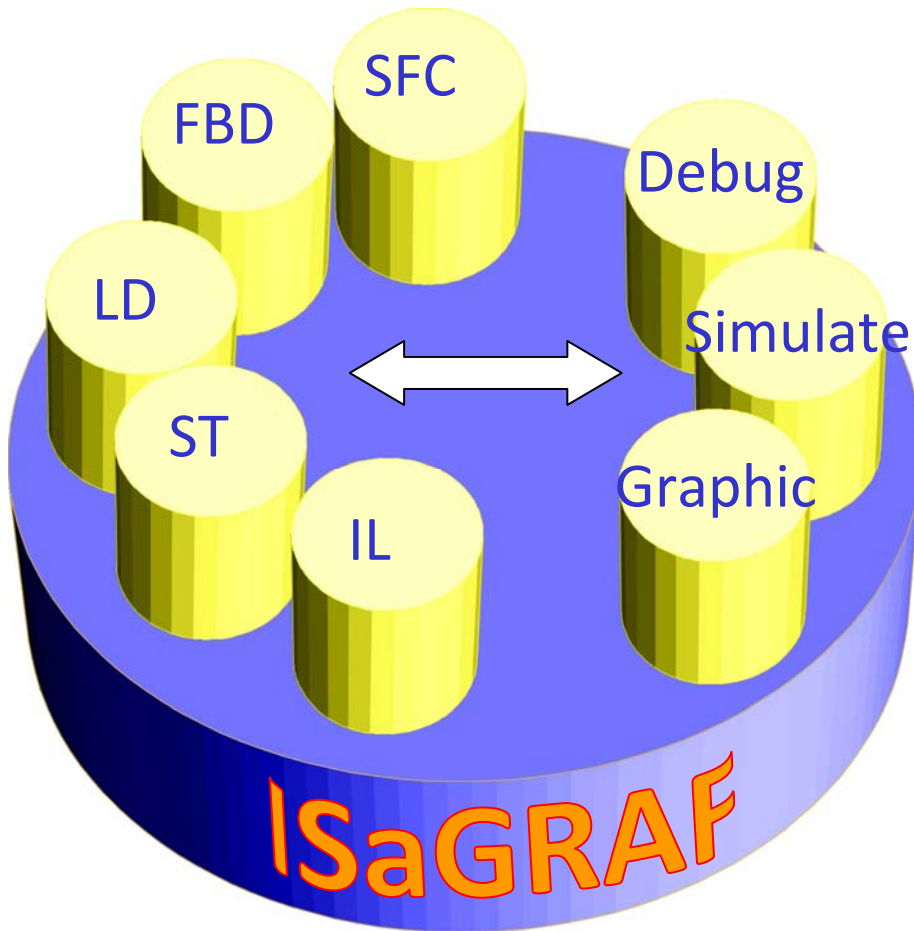


Application Story Of ISaGRAF Embedded Controller Building Automation: Remote I/O

- Alarm & lighting system of Sogo Department store.
- Three I-8417 (I-7188EG) are used.
- Many I-7000 Remote I/O modules to collect DI & AI signals.
- Some Modbus Power meter to get the power data and sent to one I-8417.
- Two HMI-software PCs.
- One LED Display panel showing some important message.

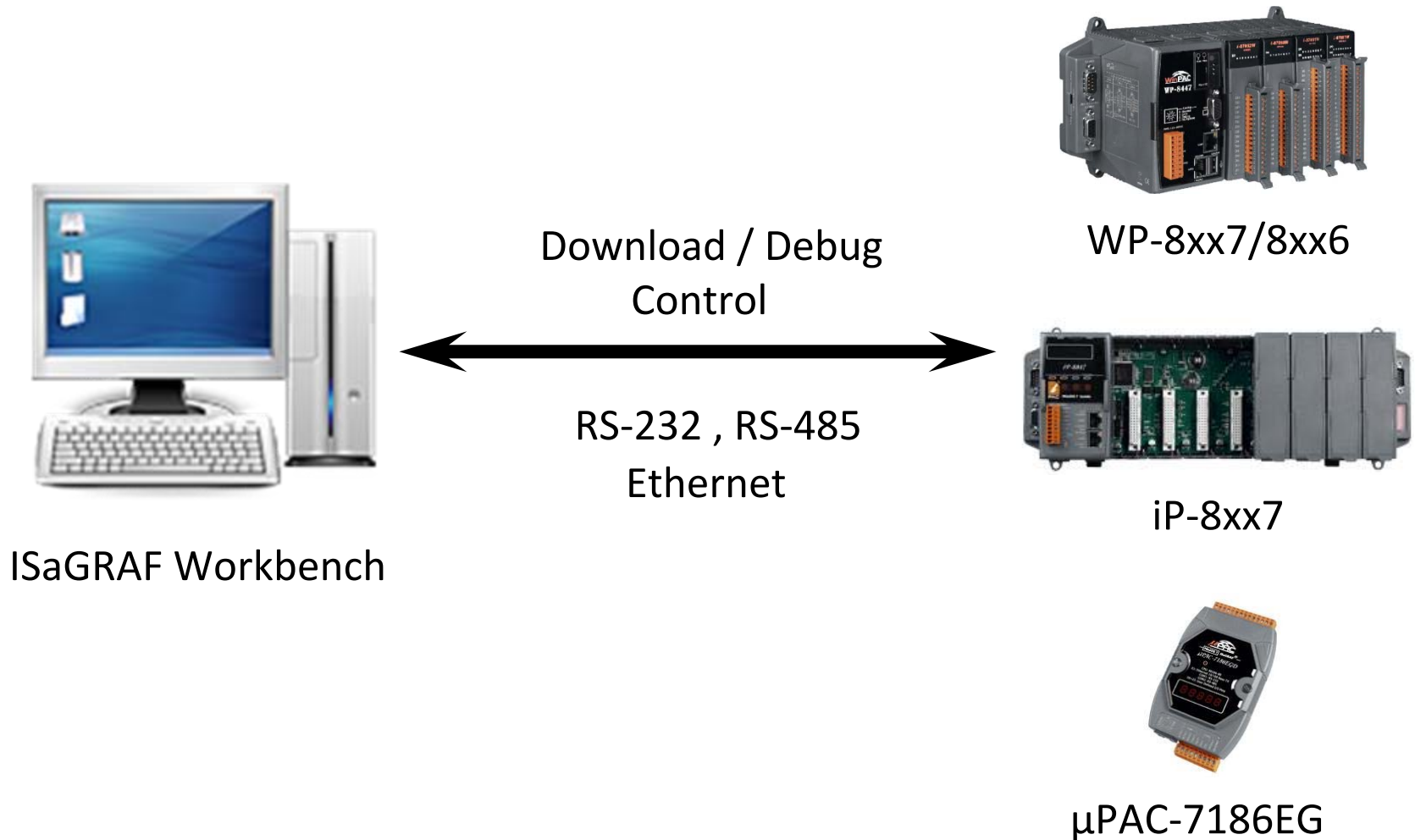


What is ISaGRAF?



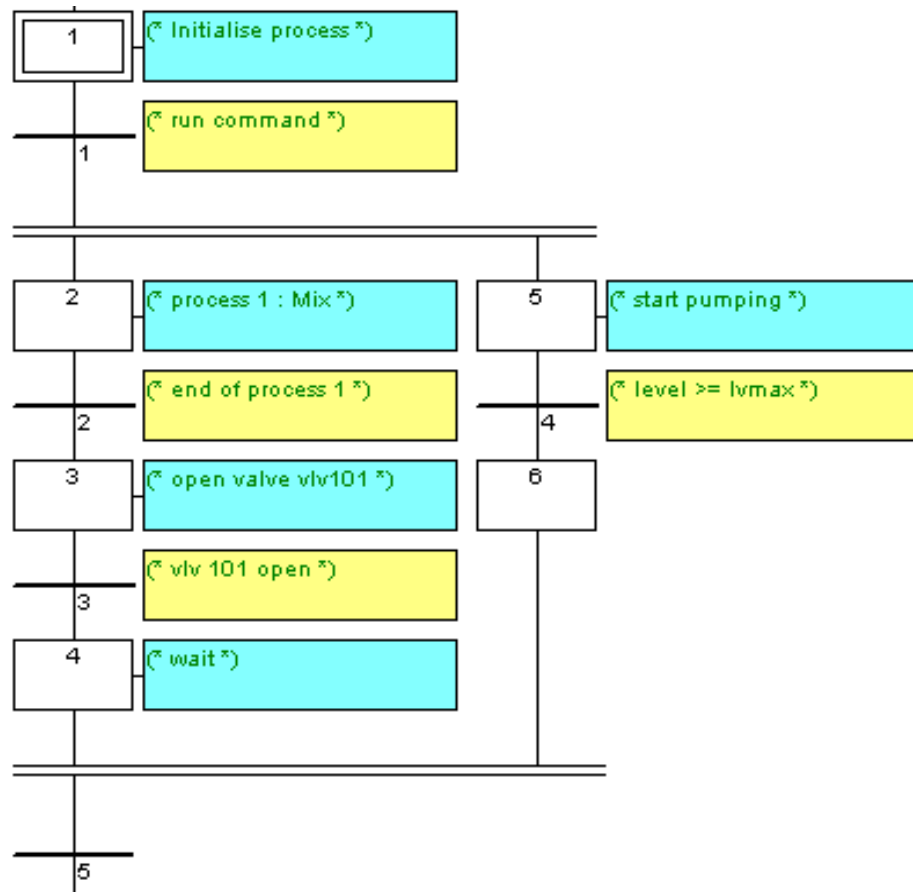
- Follow IEC 61131-3 standard OPEN PLC languages
- Support 6 languages (+ Flow Chart)
- Environment :
Windows 95, 98, NT
Windows 2000, XP

ISaGRAF : Link to Controllers



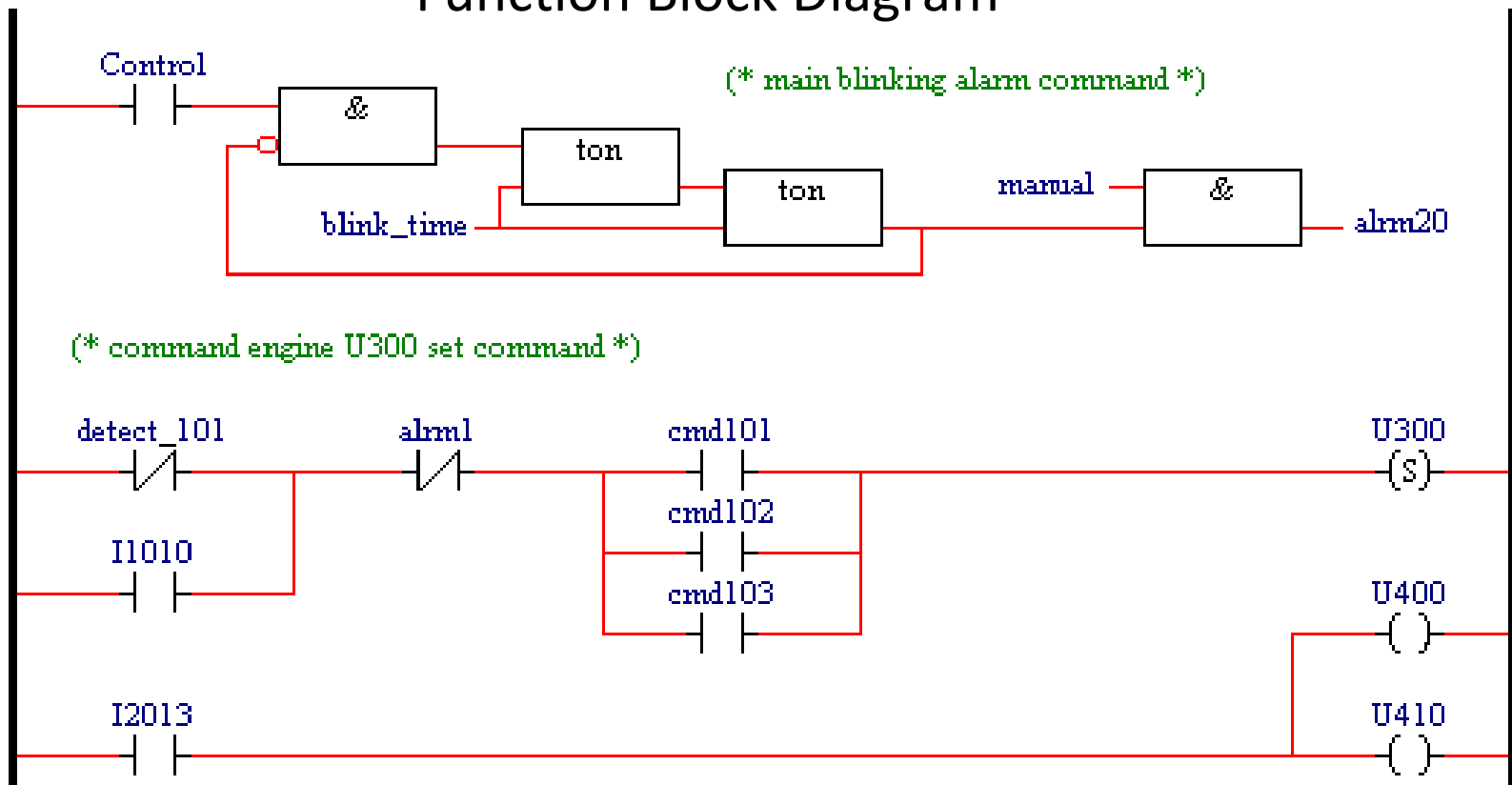
IEC 61131-3 : SFC

Sequential Function Chart



IEC 61131-3 : FBD & LD

Function Block Diagram



Ladder Diagram

IEC 61131-3 : ST & IL

Structural Text

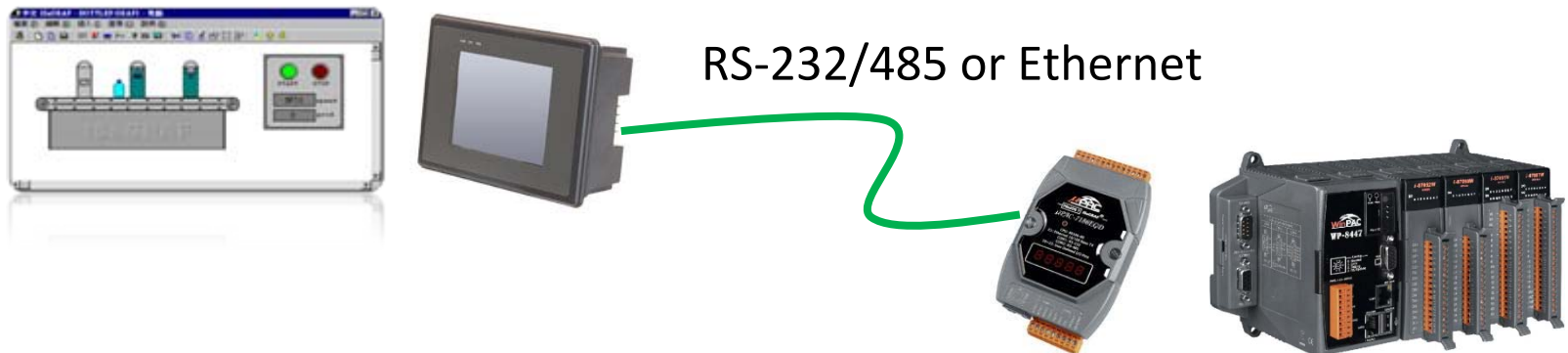
```
if (level <= level_max)
then
    out_valve := false;
    memory_vlv := (vlv23+dbh18)/2;
else
    alarm_level := true;
    out_valve := false;
end_if;
```

Instruction List

```
start_cmd: LD  bi101
            ADD 10
mul_ope: MUL( interm_bcmd
            SUB bo100
            )
            ST   bcmd
            GT   top_level
            JMPNC mul_ope
```

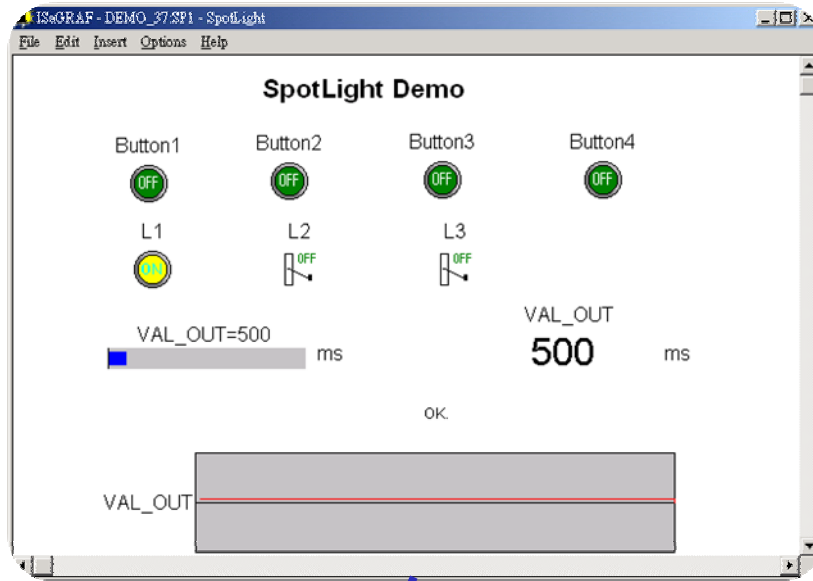
Link to HMI

- Via RS-232 / 485 or Ethernet
- Touch screens with Modbus protocol:
For example, Proface, EasyView, Exor, Hitech, ...
- PC + SCADA software:
For example, Indusoft, iFix, Intouch, Citect, Wizcon, Intellution Lookout, LabLink, ...

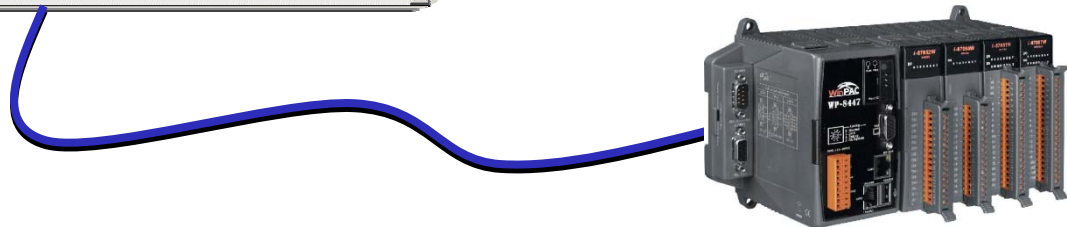


ISaGRAF Features

Spotlight: Simple HMI



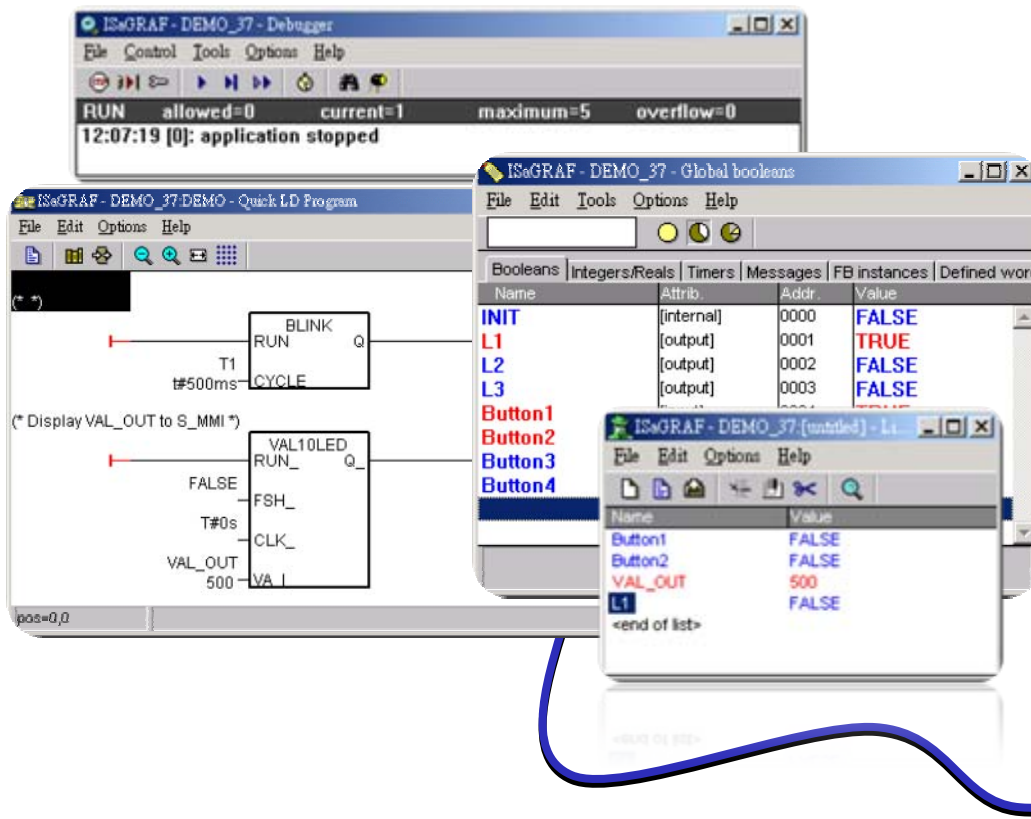
- Boolean Icon
- Bar Graph
- Trend curve
- Number
- String
- BMP



RS-232/RS-485/Ethernet

ISaGRAF Features

On-line Monitoring & Control



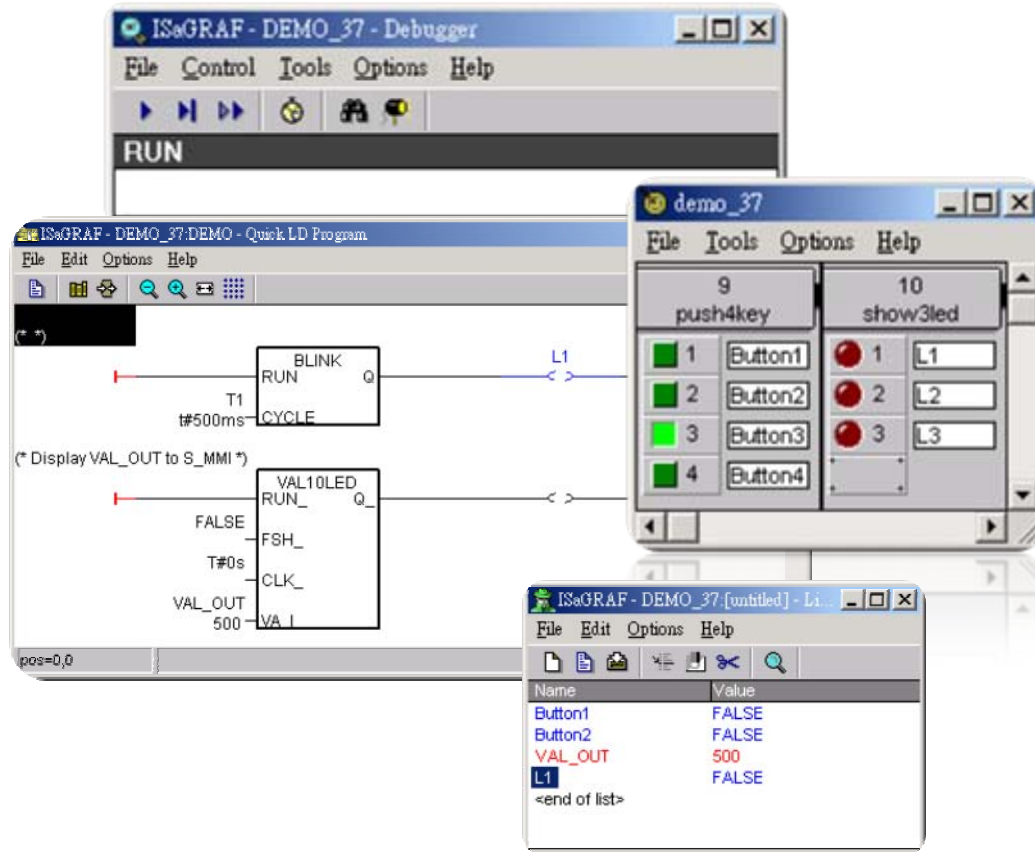
- Comm Status
- Variables
- Program Status
- List of Variables

RS-232/RS-485/Ethernet



ISaGRAF Features

Off-line Simulation

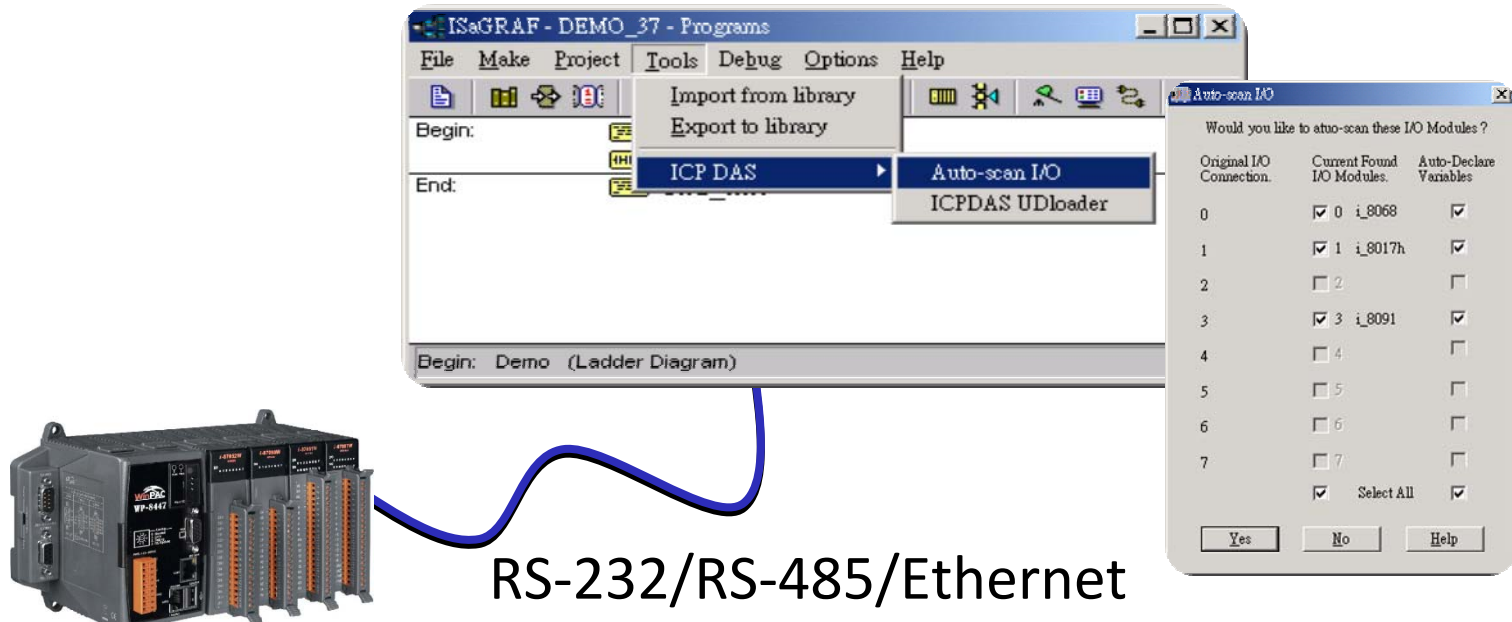


- I/O Panel
- Variables
- Program status
- List of Variables

ISaGRAF Features

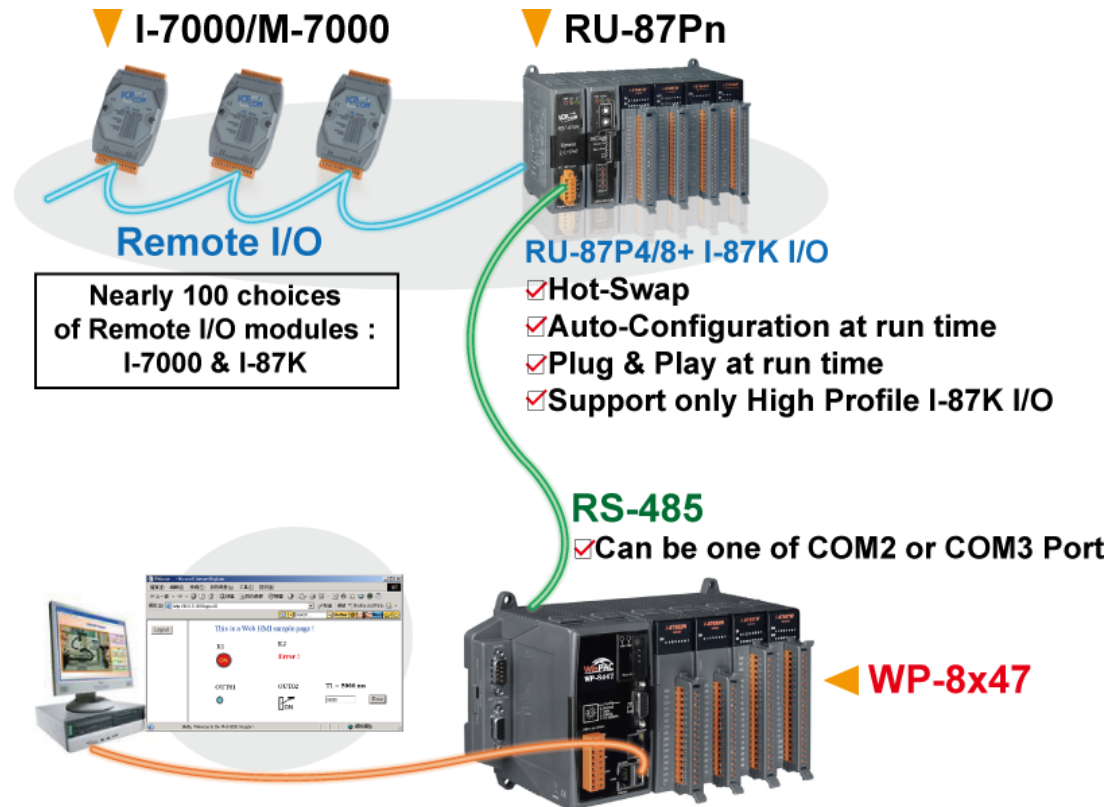
Auto-scan I/O

- For Wincon & I-8000
- Auto search I/O boards
- Auto declare I/O variables



Link To Remote I/O : I-87K & I-7000

- Two-wire RS-485
- One WinPAC connect max. 255 pcs. Of I-87K I/O boards or I-7000 I/O modules
- iP-8xx7, μ PAC-7186EG, I-7188EG/XG connect max. 64 pcs.
- Remote IO are not counted into ISaGRAF I/O Tags

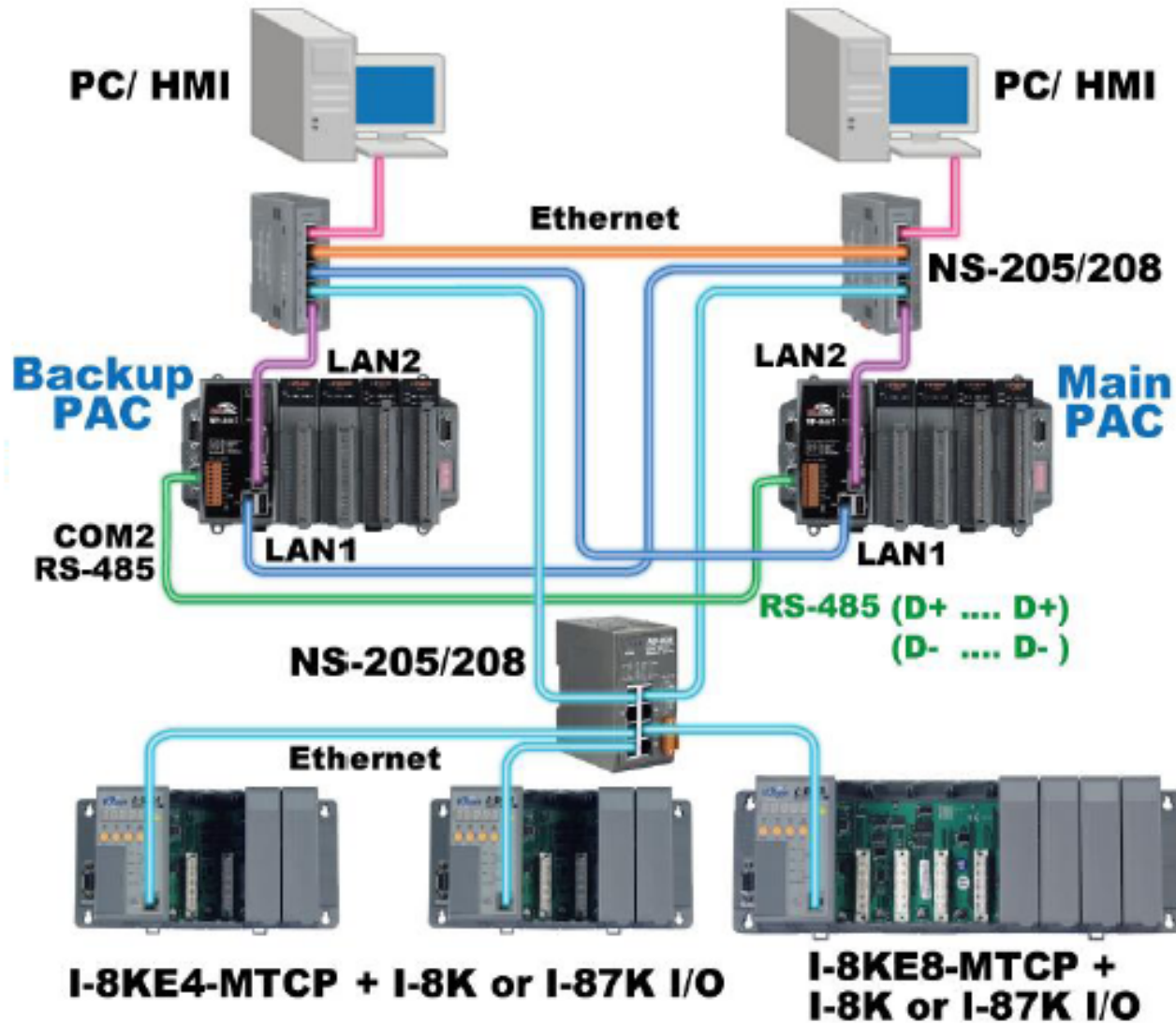


- Max distance: 1200 meters (or about 400 feet, the longer the distance, the slower the baud rate should be, < 9600 or 4800 bit/per sec for 400 feet)

[illegible]

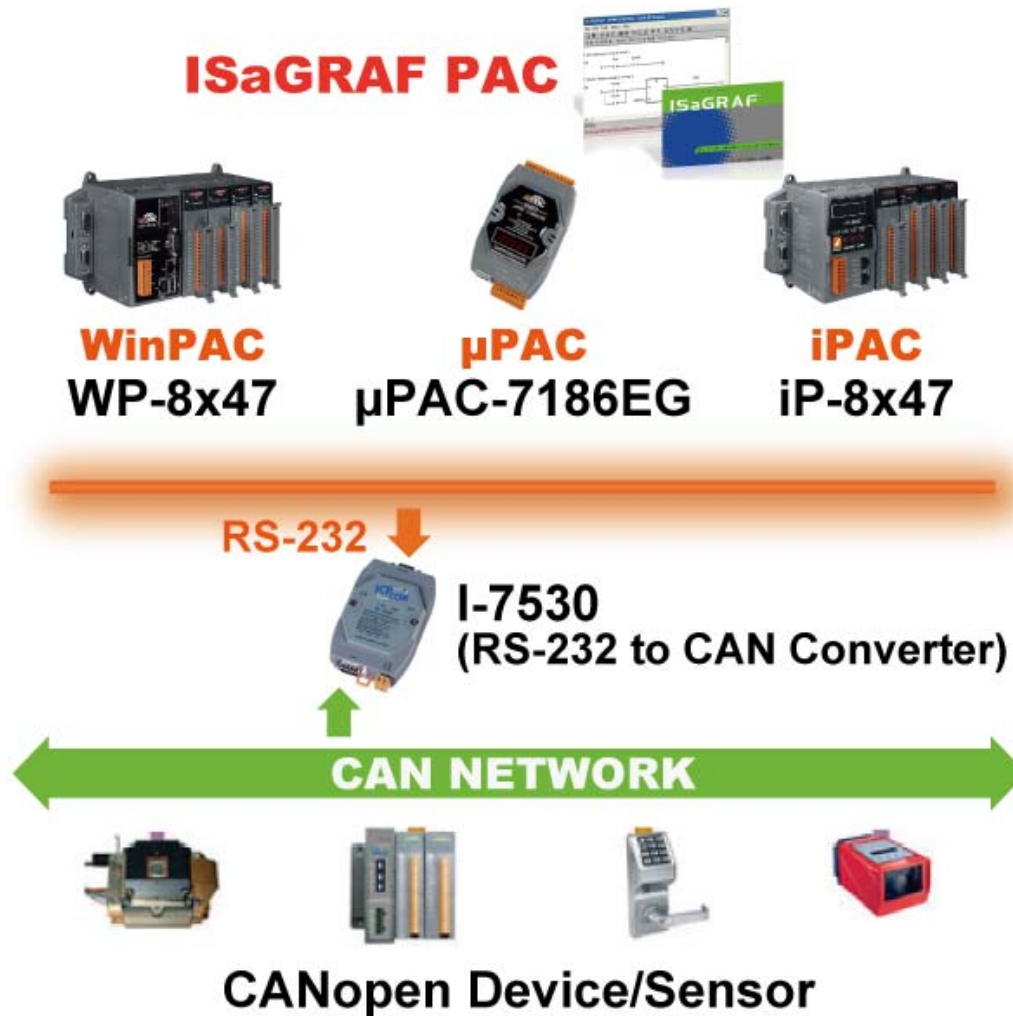
ICP DAS www.icpdas.com service@icpdas.com

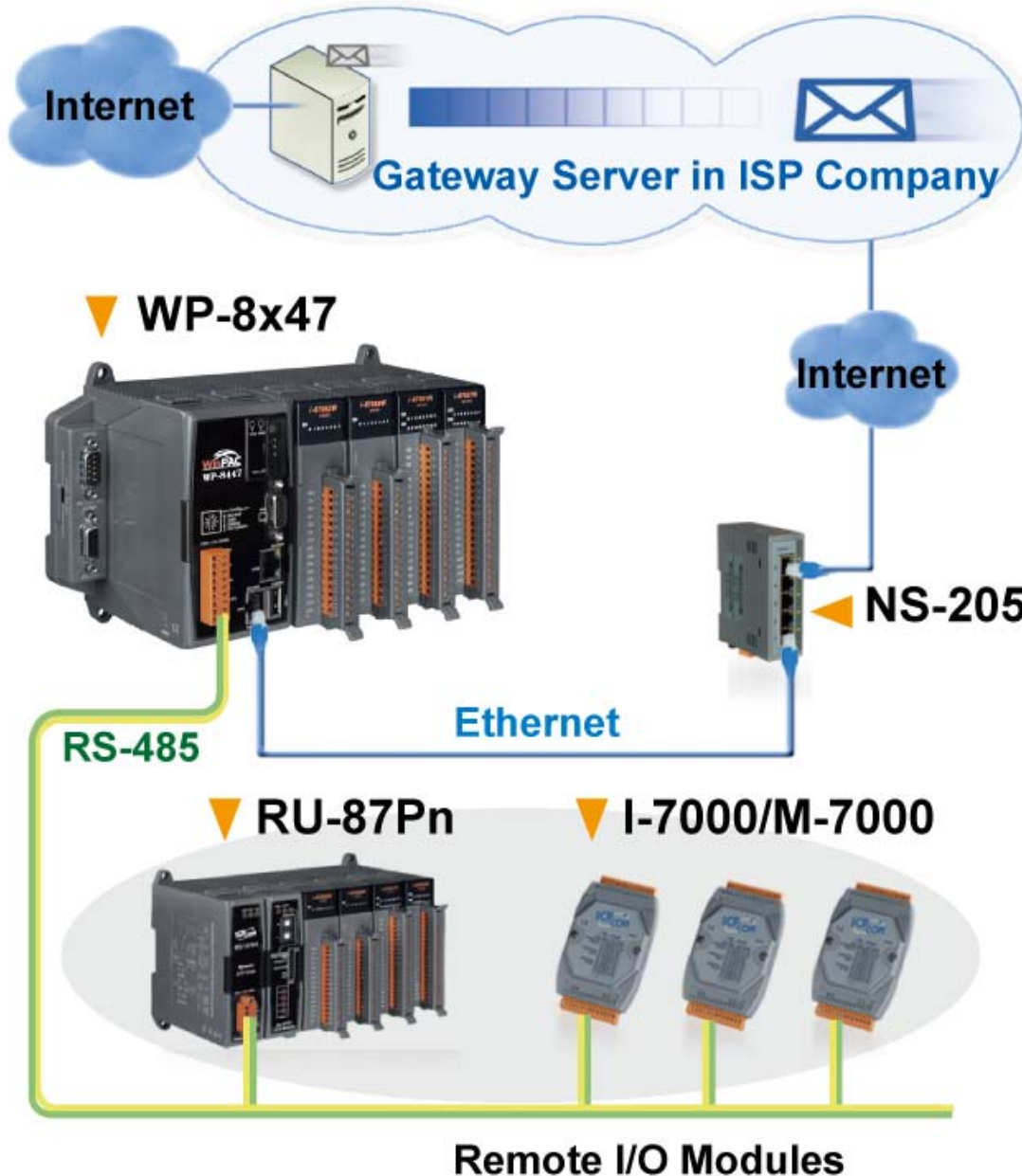
WP-8147/8447/8847 Redundant System (Ethernet I/O)



Redundant System (2)

Integrated with CAN/CANopen Devices





WP-8xx7
iP-8xx7
μPAC-7186EG

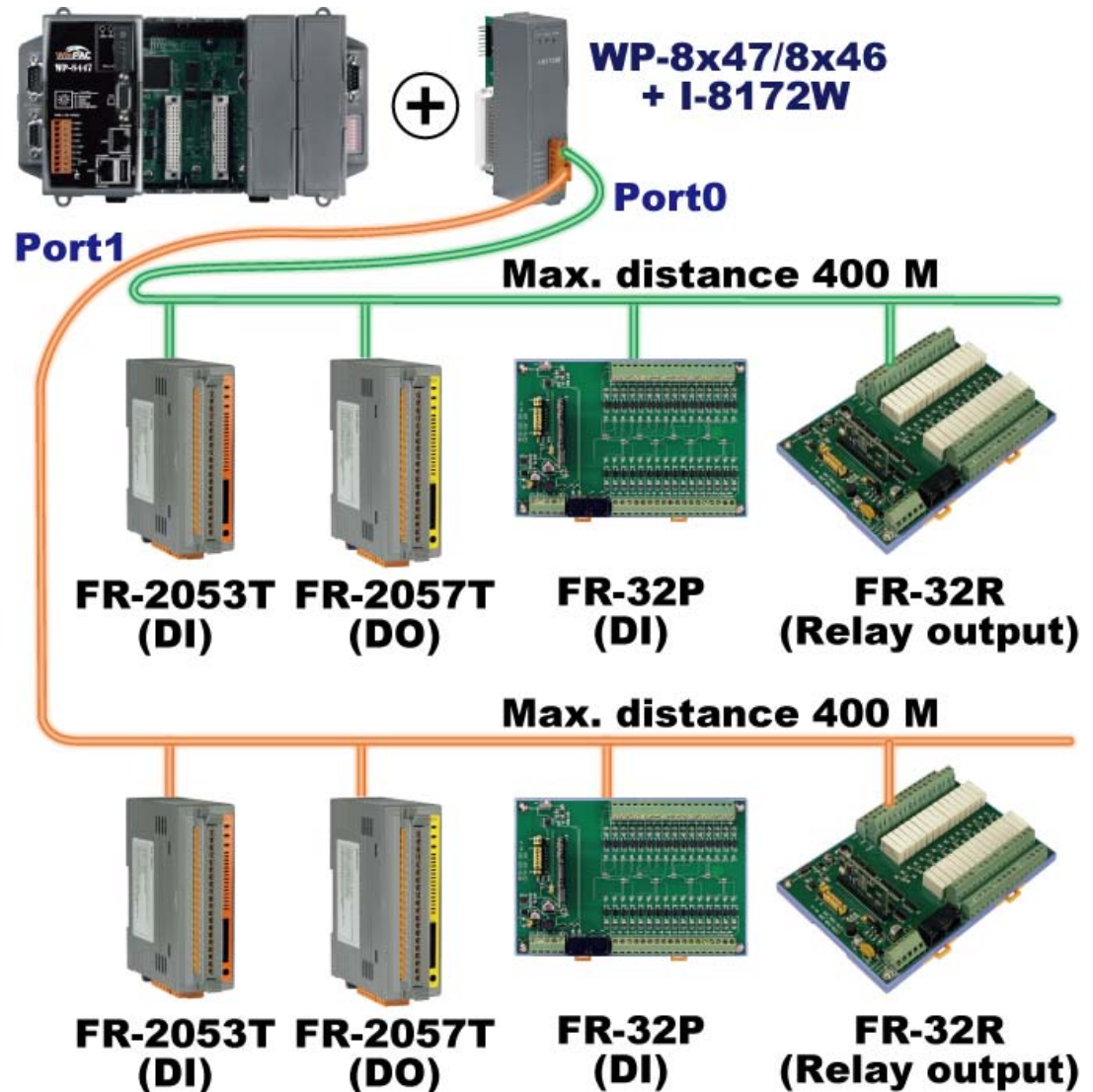
Support Sending
E-mail
and / or
E-mail with One
Attached File

FRnet I/O

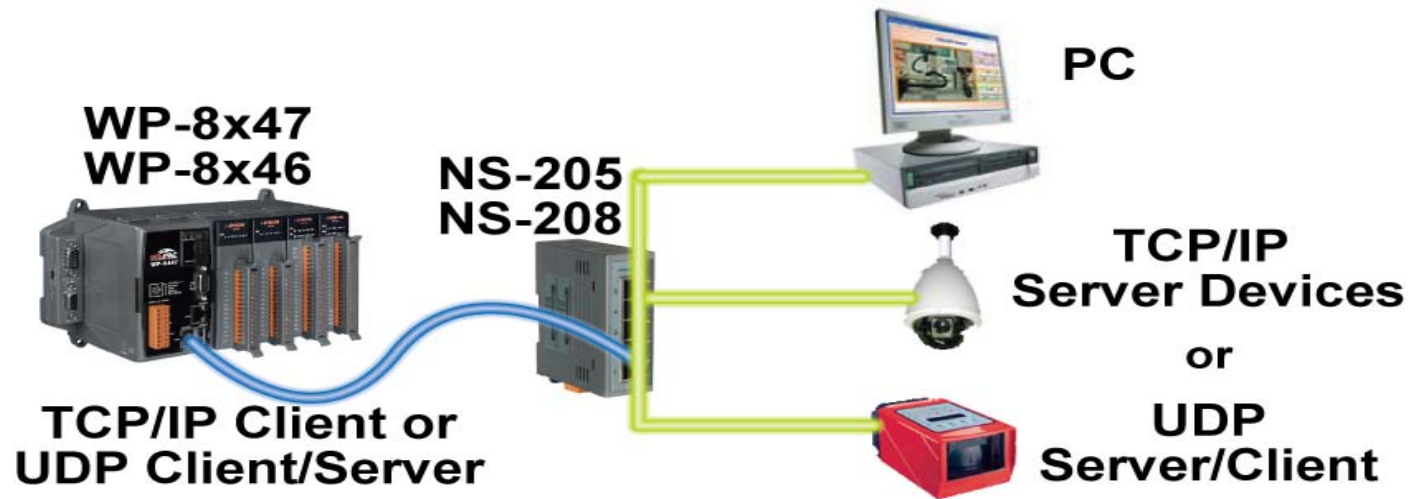
WP-8xx7 , iP-8xx7

Fast Digital I/O scan :
about 3 ms for up to
1792 DI plus 1792 DO,
depends on PLC scan
time

FRnet not supporting
Analog I/O yet



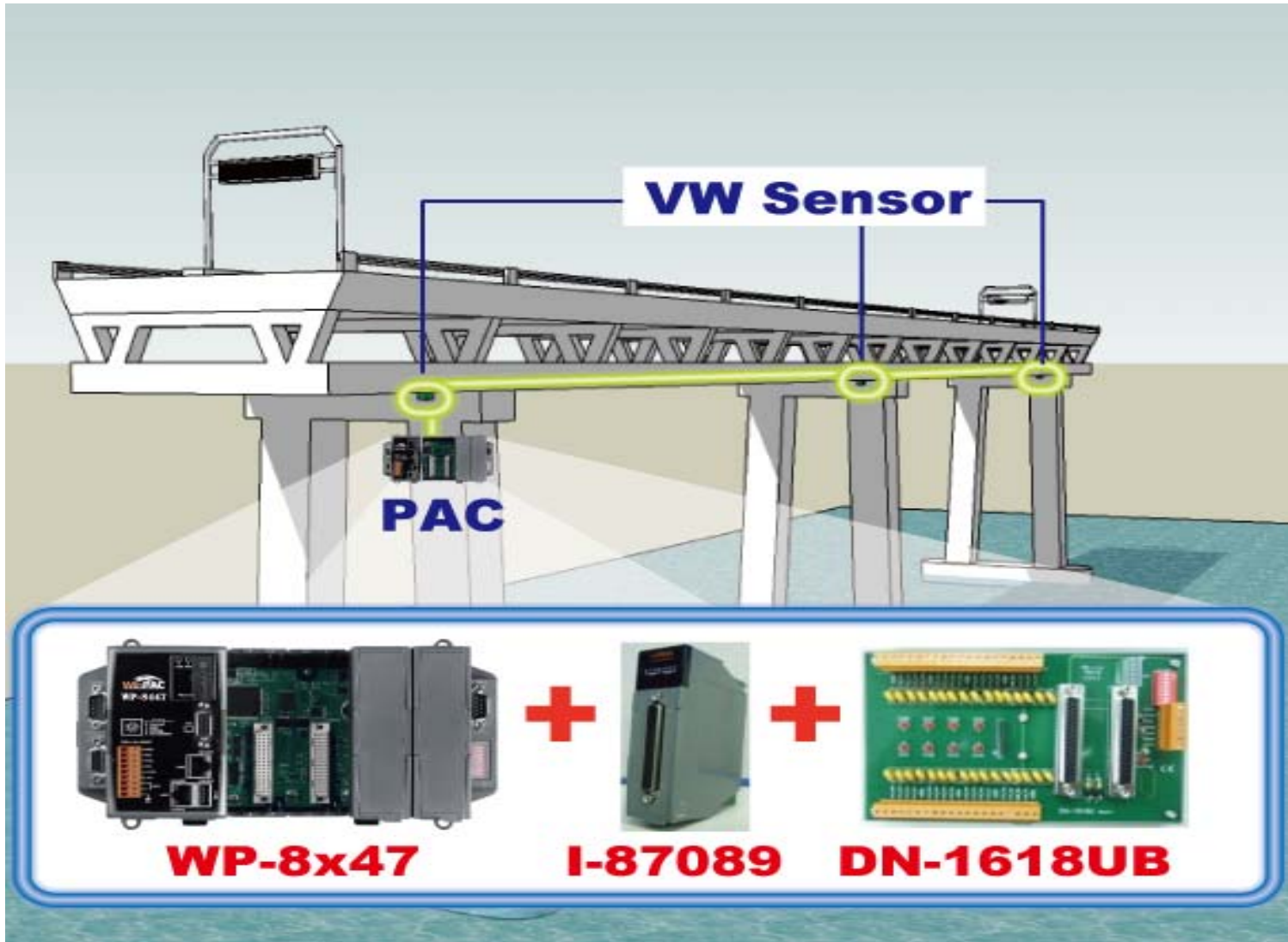
Communicate With Other TCP/IP Server and/or UDP Client/Server Devices



- WinPAC-8xx7 support TCP/IP Client to link to other device which supports TCP/IP server
- WinPAC-8xx7 support UDP Client & Server to link to other device supports UDP
- iP-8xx7 and μ PAC-7186EG supports UDP Client & Server to link to other device supports UDP

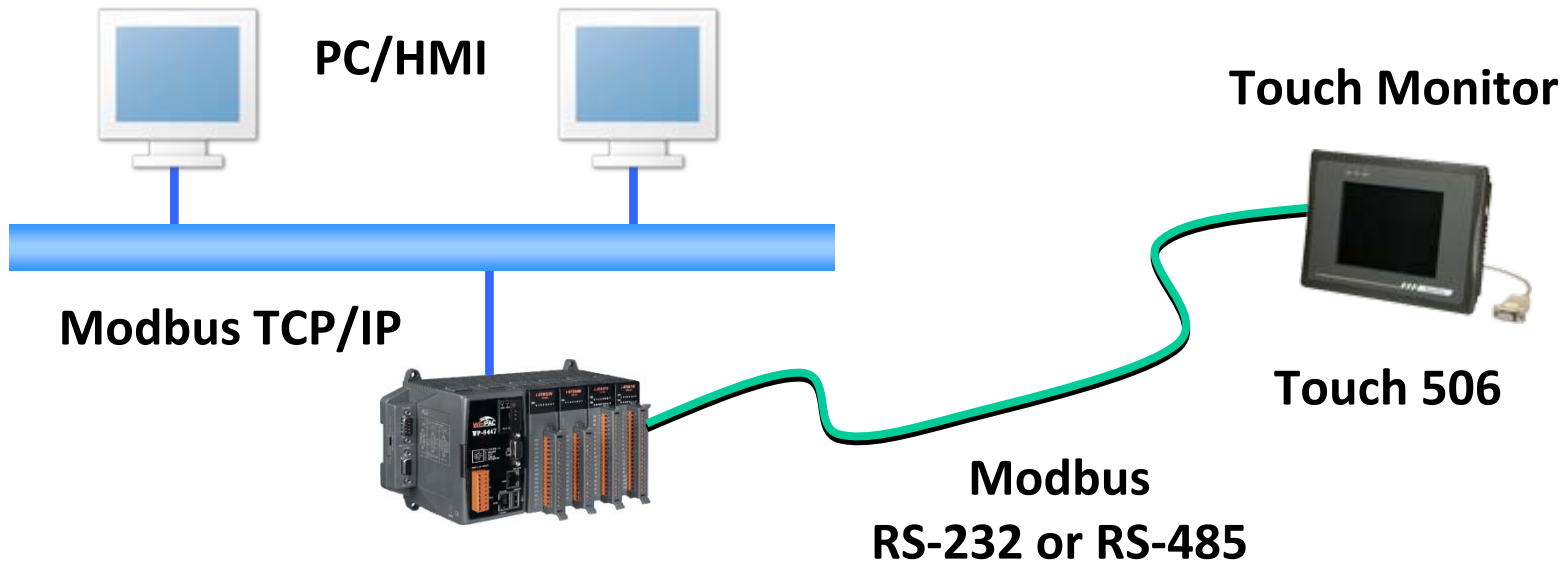
Stress Monitoring Application.

WP-8xx7 and iP-8xx7



Controller Features

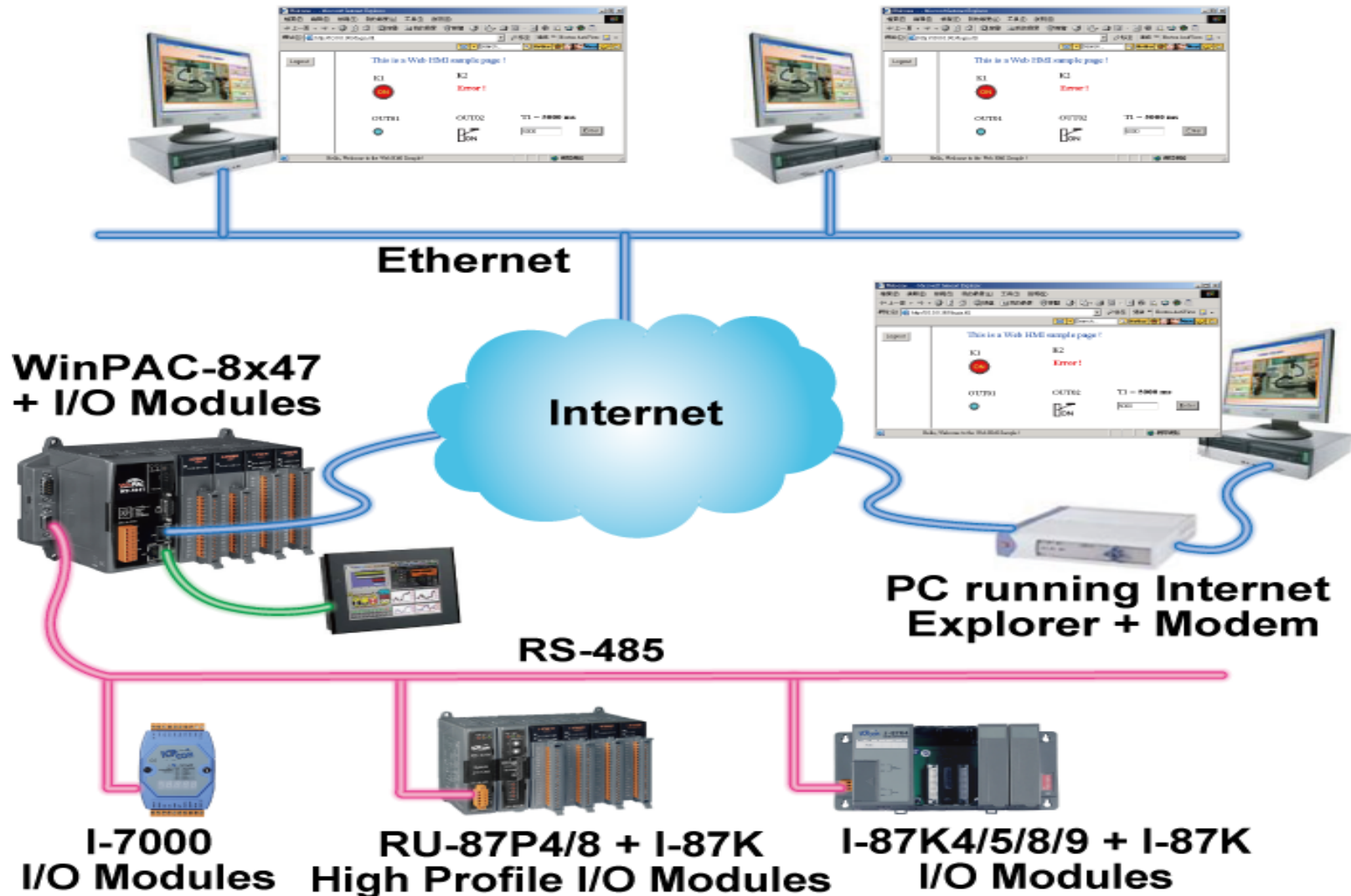
Modbus Slave Protocol



- Modbus TCP/IP slave
(WP-8xx7 : 32 connections, iP-8xx7, μ PAC-7186EG: 6 connections)
- Modbus RTU slave
(WP-8xx7 : Max 5 ports , iP-8xx7, μ PAC-7186EG : Max 2 ports)

Web HMI (WP-8xx7)

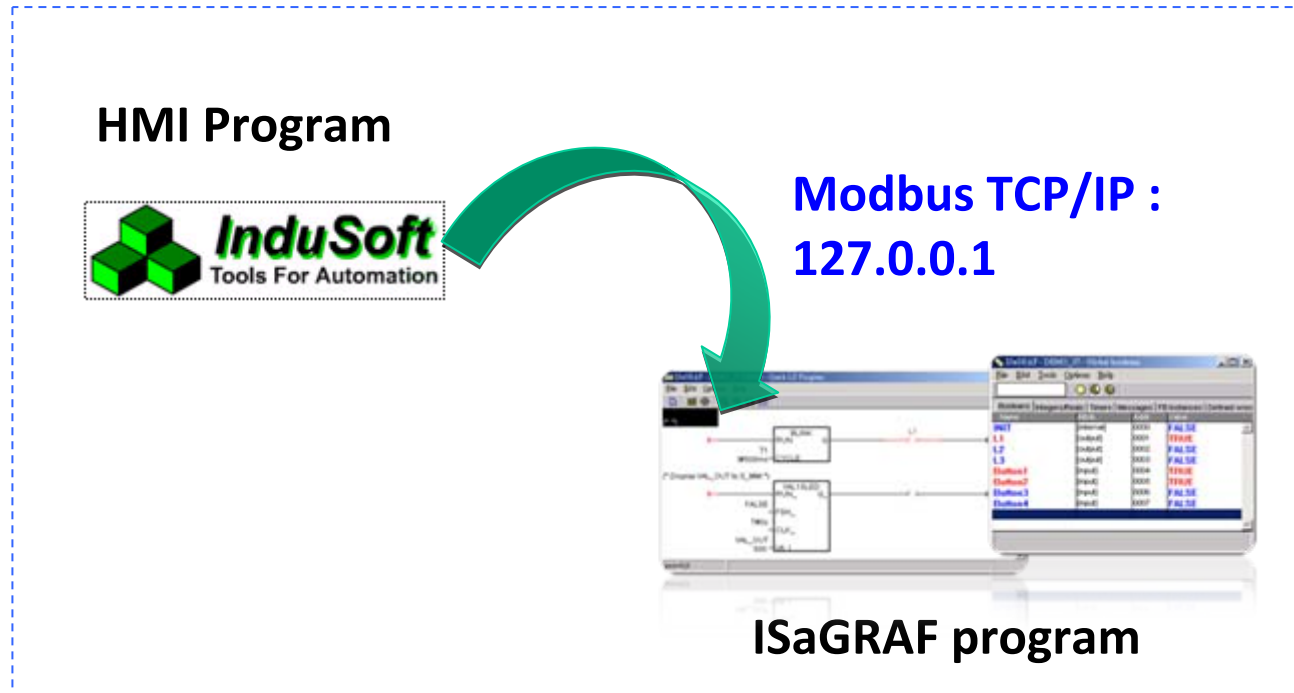
PC Running the Internet Explorer



Controller Features

Modbus TCP/IP Protocol

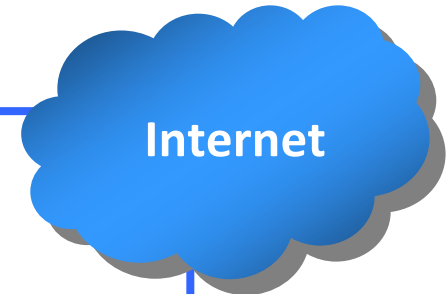
Local Host: 127.0.0.1



- HMI & ISaGRAF program can run inside the same **Wincon**
- HMI can request & command ISaGRAF program by using Modbus TCP/IP protocol via local host IP: 127.0.0.1

InduSoft Web ThinClient

Remote Visualization
(Web Thin Client)



WP-8x46

- WP-8xx6 supports InduSoft Web feature. PC doesn't need InduSoft RunTime, just run Internet Explorer.
- InduSoft Development Kit at design time:
 - 300 Tags: Indusoft-NT300D
 - 1500 Tags: Indusoft-NT1500D
 - 4000 Tags: Indusoft-NT4000D
 - 64000 Tags: Indusoft-NT64000D

Controller Features

One HMI Link to Many Controllers Via Ethernet



Ethernet : Modbus TCP/IP Protocol



WP-8xx7 / 8xx6



iP-8xx7



μPAC-7186EG

SMS

(WP-8xx7 , iP-8xx7 and μ PAC-7186EG)



Controller Features

Motion Control

- WinPAC-8xx7 or iP-8xx7
- I-8091W: 2-axis motion control board (pulse output), No encoder
- One (2-axis) or two (4-axis) I-8091W can be used
- Provide functions of

Move to Home, Stop

Independent pulse move for all axes

Independent speed move for all axes

Dependent X-Y line, curve or circle Emergency ,

limit switch protection, Accelerate, decelerate and more ...

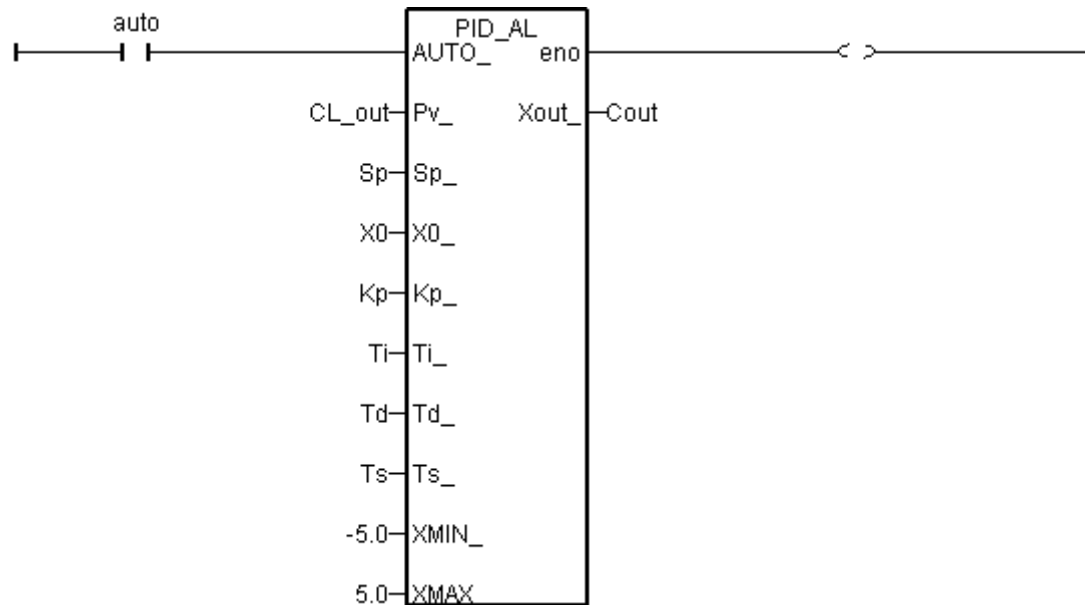


- I-8084W: 4-axis Encoder without Z-index
- I-8090W: 3-axis Encoder

Controller Features

PID Control

- Provides function block - “PID_AL”



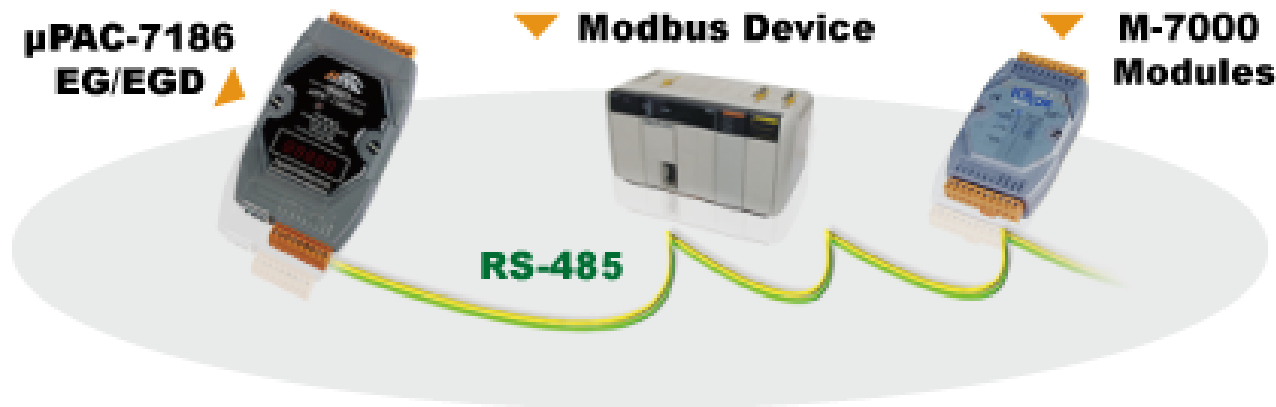
Controller Features

Read/Write File

- WP-8xxx7 / 8xx6
- ISaGRAF provides functions -
 - “F_ROPEN”, “F_WOPEN”, F_EOF”, “F_CLOSE”,
 - “FA_READ”, “FA_WRITE”, “FM_READ” , “FM_WRITE”to Read/Write Integer & Message (String) stored in the “Compact Flash Memory” or in the “RAM disk”

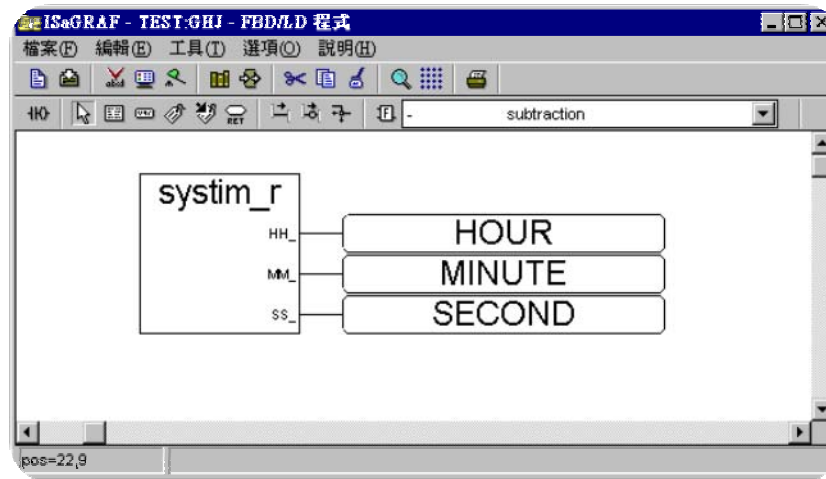
Modbus Master Protocol

- **Modbus Master protocol**: Two formats, **ASCII** and **RTU**. RS-232 or RS-485 or RS-422
- Connect to device which supports Modbus slave protocol, for ex. , Power Meter or Inverter
- WP-8xx7 supports many Modbus Master ports (Max **10** ports), can be RS-232/485/422
- iP-8xx7, 7186EG supports max. **two** Modbus Master ports



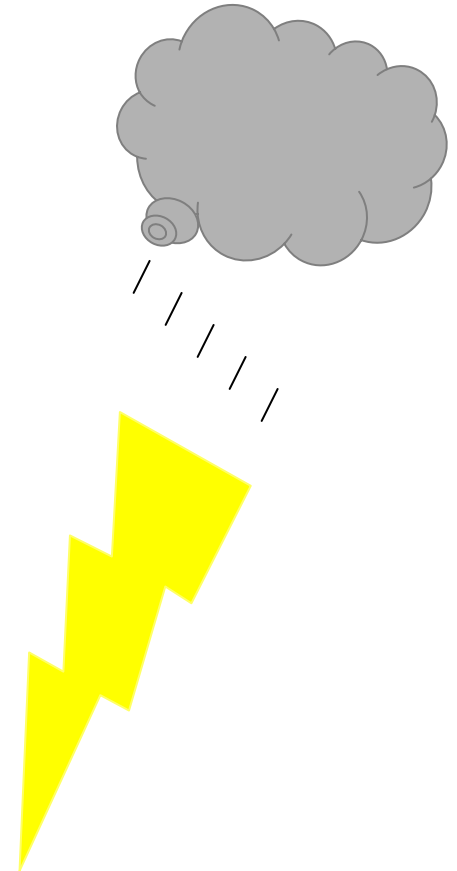
Real Time Clock

- Year 、 Month 、 Date 、 Week date
- Hour 、 Minute 、 Sec
- R/W by using ISaGRAF Function Blocks

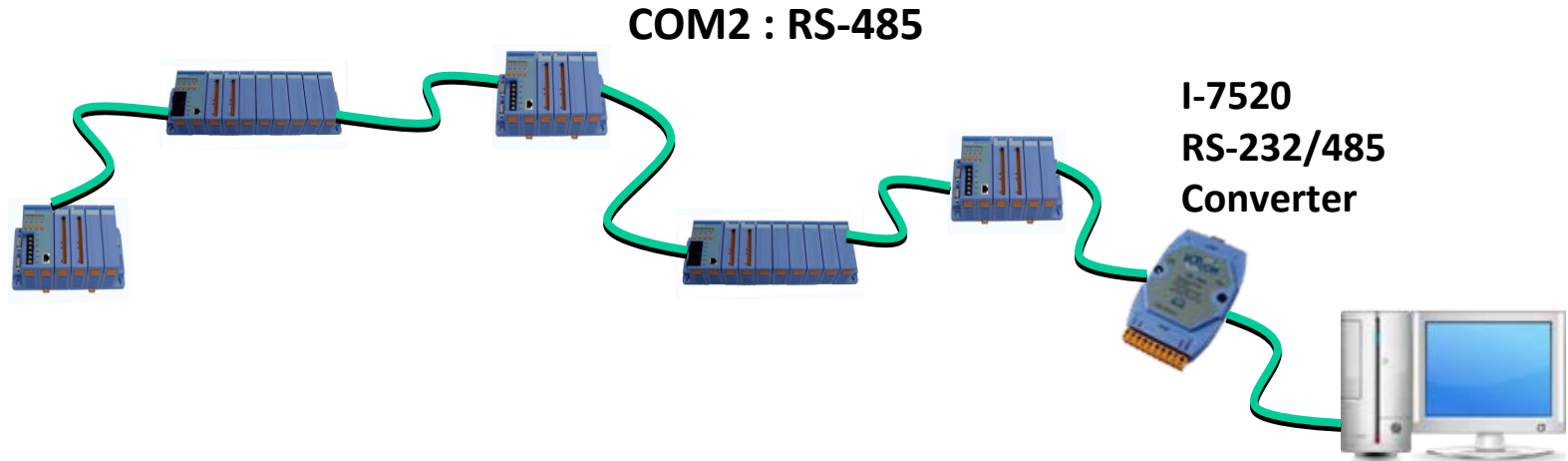


Stability

- Operation temp : -25 ~ +75 °C
- Storage temp: -30 ~ +85 °C
- Humidity : 5 ~ 95% non-condensed
- Watchdog
- Protection circuit



RS-485 Networking



- Use RS-485
- 1 PC connects to max. 255 iP-8xx7 or I-7188XG on a RS-485 network for programming , control or monitoring
- Modbus protocol: easy integrated with HMI or SCADA software
- Max. distance to 1200 M (with baud rate ≤ 9600)

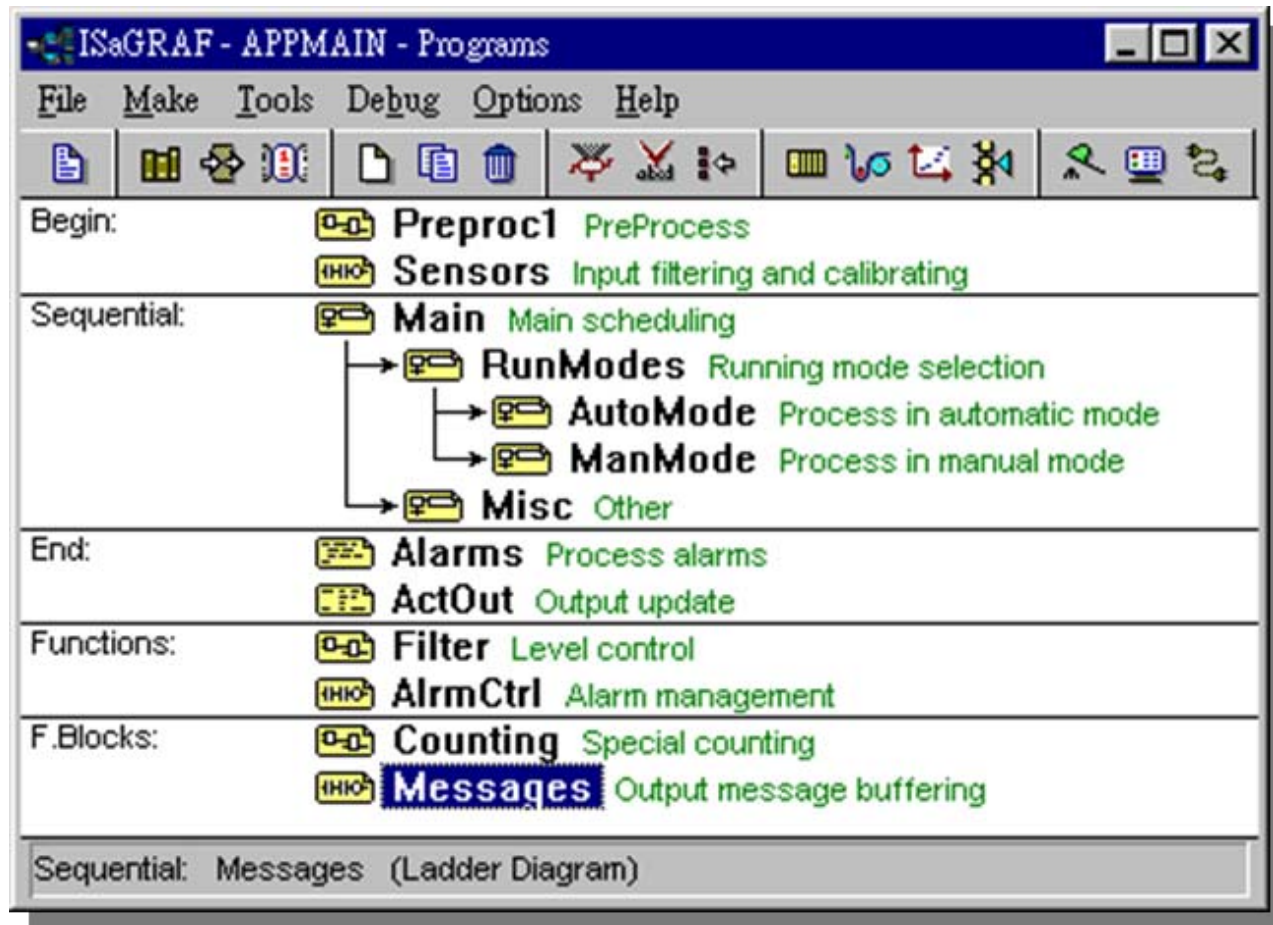
Ebus / Fbus Data Exchange

- Ebus using Ethernet
- Fbus using RS-485
- Controllers can freely access to other Controller
- No limitation of how many Controllers
- Using ISaGRAF function blocks
- WP-8xx7 doesn't support Fbus.

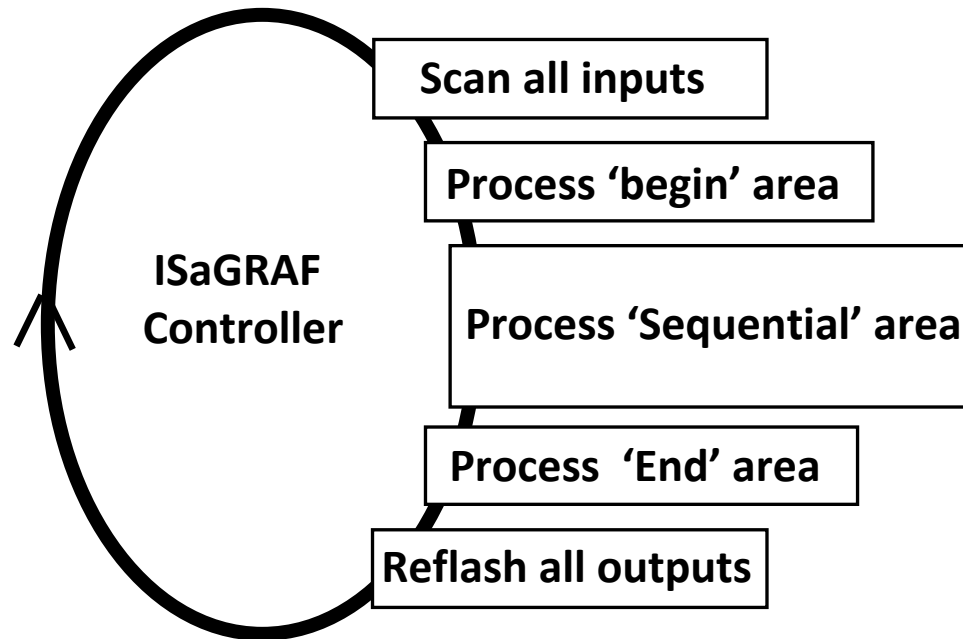


ISaGRAF Programming

ISaGRAF Application

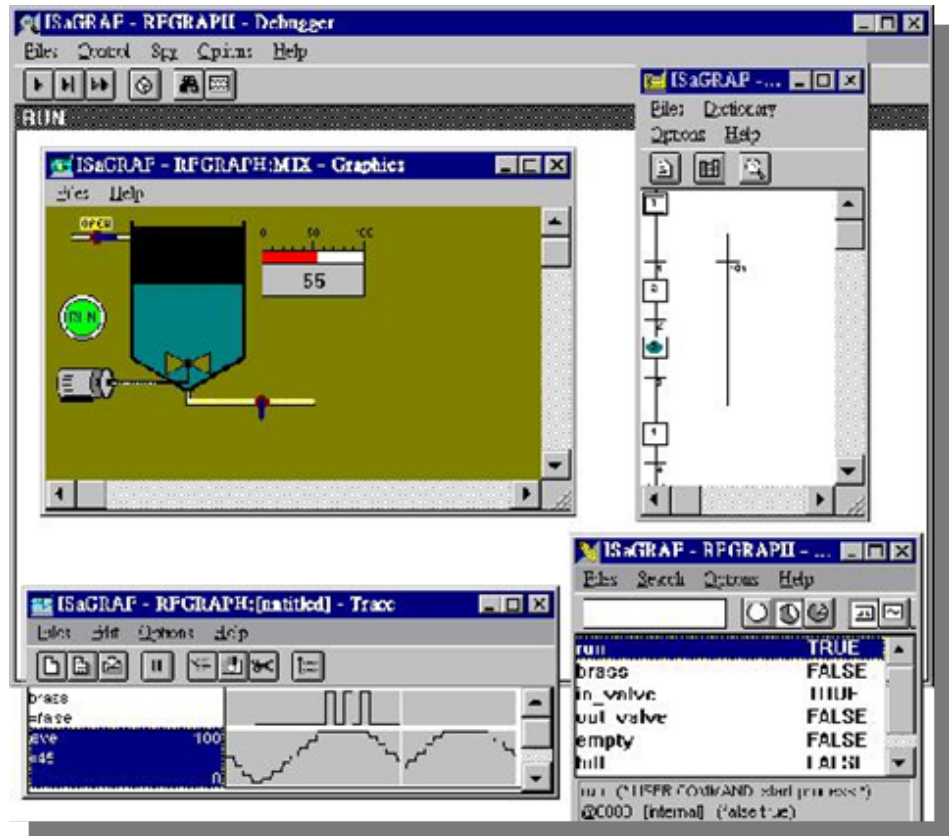


ISaGRAF Cycle



ISaGRAF : Debugging

- All variables and program's run time status are seen on screen
- Trace variables
- Interrupt setting
- Spotlight
- Simulation on PCs



Variable

- **Type** : Boolean, Analog, Timer, Message
- **Attribute** : Internal, Input/Output, Constant
- **Network address**:
If link to HMI, variables should be set a network address within
WP-8xx7:0001 ~ 3FFF hex(1 ~ 8191)
iP-8xx7, 7186EG / 7188XG: (1 ~ 4095)
- Can be “Local” to a program or “Global”.
Attributed with Input/Output are all Global.

Variable Declaration

- **Name**

- Max to 16 Characters (32 chars since ISaGRAF 3.5x)
- The first char should be a letter A~ Z , others could be digits 0~9, letters A ~ Z or underscore char “_”
- Case insensitive, for ex. name “OUT” is the same as “Out”
- Can not use reversed word. For ex. “IF” , “AND”

- **Network address**

- Can be WP-8xx7:0001 to 3FFF hex (1 ~ 8191)
iP-8xx7, 7186EG / 7188XG: 1 ~ FFF hex (1 ~ 4095)
- If not defined, default is 0000, not accessible by HMI.

Boolean Variable

- **Value :**
 - TRUE or FALSE
- **TRUE / FALSE** could be replaced to other string on debug mode

Analog Variable

- **Value :**

- Signed 32 bit integer : 123, -12, 16#4FCF, 8#1756, 2#010
- 16# means value represented in hexadecimal, 8# : Octal
2# : Binary
- 32 bit real : 123.0, -543.987, 1.765E+03

- **Format :**

- Integer or Real

Timer Variable

- **Value :**

- Unit is ms, that is 0.001 sec
- t#1h450ms, T#0s
- Max to t#23h59m59s999ms
- Must be positive
- T#10.5s is wrong. ==> T#10s500ms is correct
- Case insensitive. For ex. T#10m25S is same as t#10M25s

Message Variable

- **Value :**

- " , 'Hello' , '\$41'
- '\$41' means 'A' , '\$0D' means CR from ASCII table.
- All char can be used except '\$00'

- **Length :**

- Declare max number of characters can be used
- max length is 255

Variable Array

- Boolean , Integer, Real & Timer can declared as “Variable array”
- Please adds two more lines on the top of your ISaGRAF installed directory, For example: “c:\isawin\exe\isa.ini”

Add 2 rows on the top

[DEBUG]

arrays=1

More information at www.icpdas.com → FAQ → Software
→ ISaGRAF → Faq 039

Variable Array

Integer/Real Variable

Name: VAL Network Address:

Comment:

Unit: Conversion: (none)

Attributes:
☒ Internal
☐ Input
☐ Output
☐ Constant

Format:
☒ Integer (standard)
☐ Real

Initial value:

☐ Retain

Dim: 10

Store
Cancel
Next
Previous
Extended

More information at www.icpdas.com → FAQ → Software → ISaGRAF → Faq 039

Type Conversion

- **ANA** : Convert Real or Boolean or Message to Integer

ANA(5.67) = 5

ANA(True) = 1

ANA(T#2s150ms) = 2150 ANA('-4567') = -4567

- **Real** : Convert Integer to Real

Real(3) = 3.0 Real(-5432) = -5432.0

- **TMR** : Convert Integer to Timer

TMR(2345) = T#2s345ms

TMR(400005) = T#400s5ms

Type Conversion

- **Boo** : Convert to Boolean

Boo(23) = True Boo(0) = False Boo(1)=True

- **Msg** : Convert Boolean, Integer to Message

Msg(True) = 'True' Msg(-54320) = '-54320'

- **Real_str** : Convert Real to Message

Real_str(1.2345) = '1.2345'

Real_str(123456789.0) = '1.23457E+008'

Real_str(0.000012345) = '1.2345E-005'

Type Conversion

- **real_str2** : Convert Real to Message

`Real_str2(1.2345, 2) = '1.23'`

`Real_str2(123.0, 3) = '123.000'`

`Real_str2(0.012345, 3) = '0.012'`

- **str_real** : Convert Message to Real

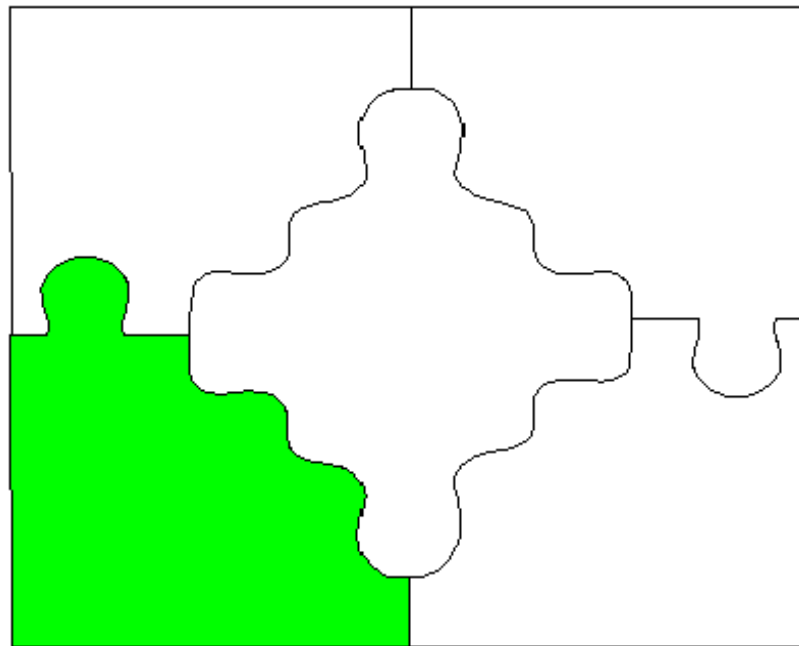
`str_real('1.2345') = 1.2345`

`str_real('-0.0345') = -0.0345`

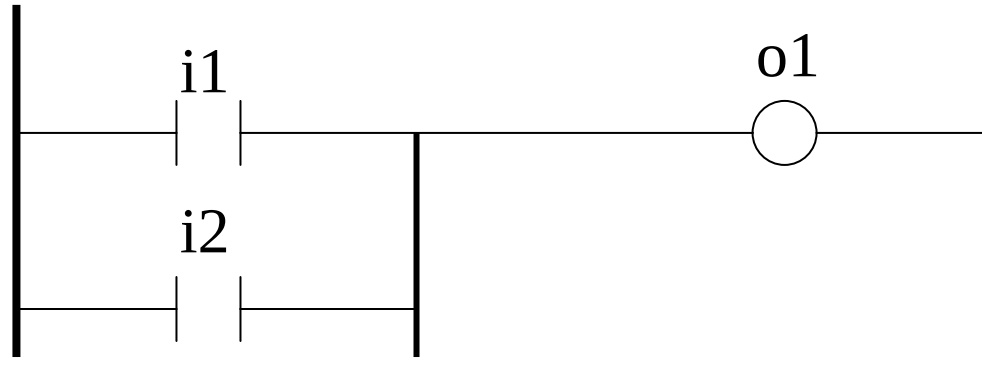
`str_real('Hello') = 1.23E-20 (format Error)`

`str_real('5.3A') = 1.23E-20 (format Error)`

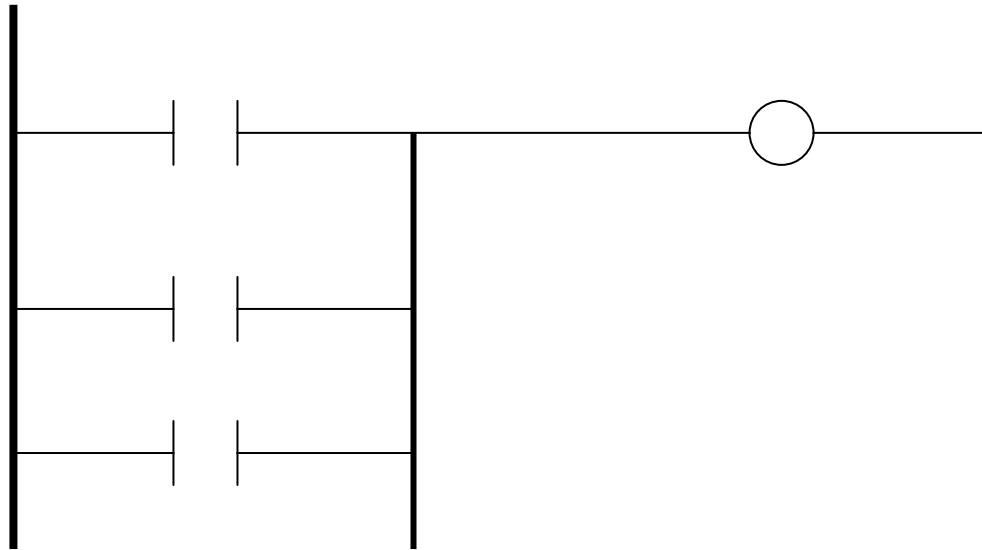
Ladder Diagram



LD rungs and rails

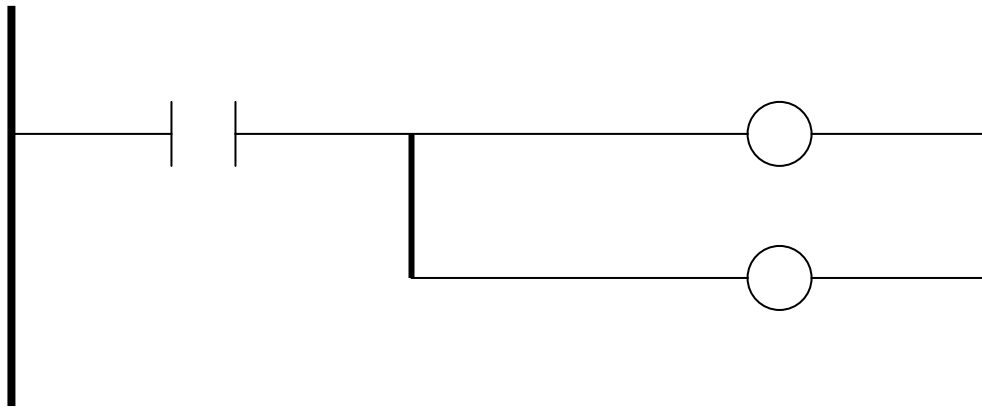


Parallel link on the left



Boolean OR operation

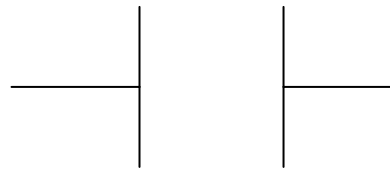
Parallel link on the right



Parallel Output

Direct Contact

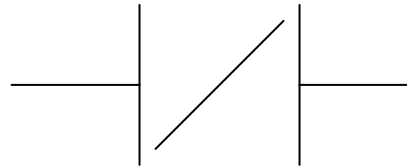
boo1



The state on the right is the logical AND between the state of the left and the value of the variable associated with the contact.

Inverted Contact

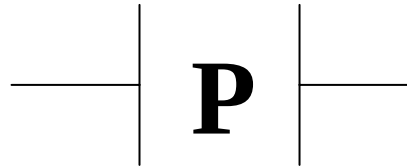
boo1



The state on the right is the logical AND between the state of the left and the **Boolean negation** of the value of the variable associated with the contact.

Contact with rising edge detection

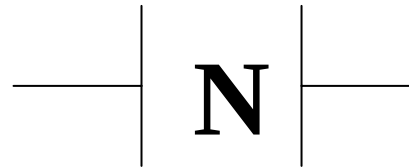
boo1



It will generate a **pulse** TRUE on the right when the state of the left is TRUE and the variable associated with the contact rises from FALSE to TRUE.

Contact with falling edge detection

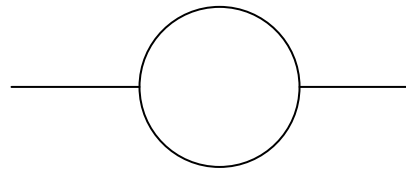
boo1



It will generate a **pulse** TRUE on the right when the state of the left is TRUE and the variable associated with the contact falls from TRUE to FALSE.

Direct Coil

boo1

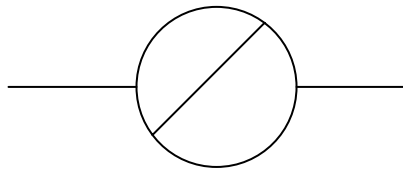


The value of the variable associated with the coil is equal to the state on the left.

Variable type should be **Output** or **Internal**.

Inverted Coil

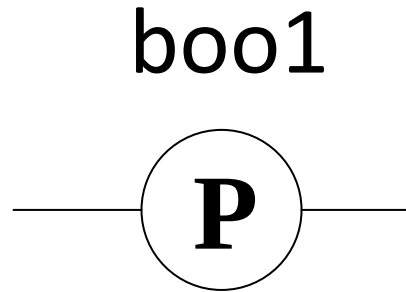
boo1



The value of the variable associated with the coil is equal to the **Boolean negation** of the state on the left.

Variable type should be **Output** or **Internal**.

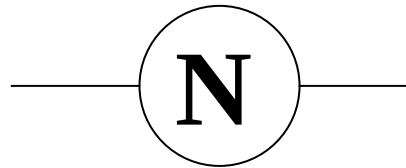
Coil with rising edge detection



The variable will generate a **pulse** TRUE when the state of the left rises from FALSE to TRUE.

Coil with falling edge detection

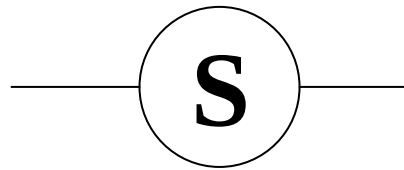
boo1



The variable will generate a **pulse** TRUE when the state of the left falls from TRUE to FALSE.

SET Coil

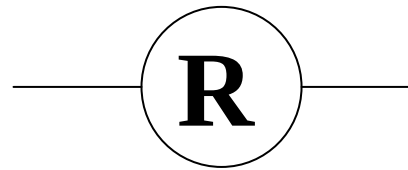
boo1



The variable **Set to TRUE** if the state of the left is TRUE. It will keep the value until it is **Reset**.

RESET Coil

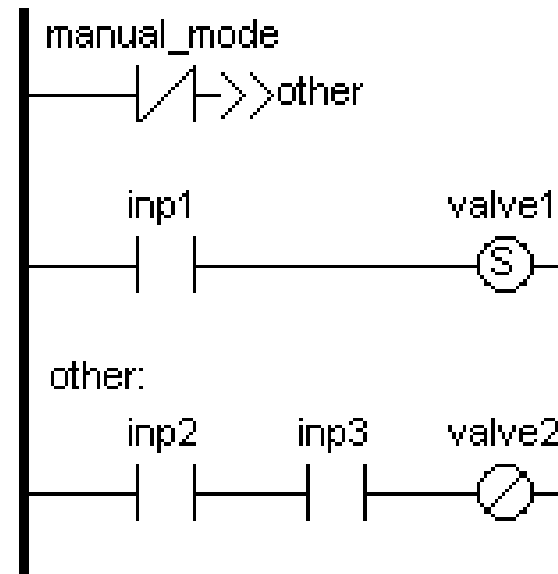
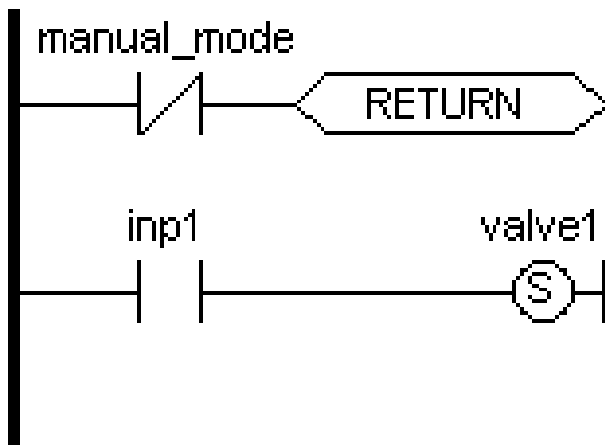
boo1



The variable **Reset to FALSE** if the state of the left is TRUE. It will keep the value until it is **Set**.

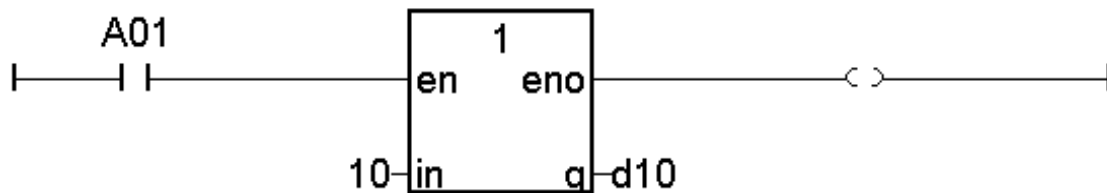
Jump , Label , Return

- Control the flow of LD program



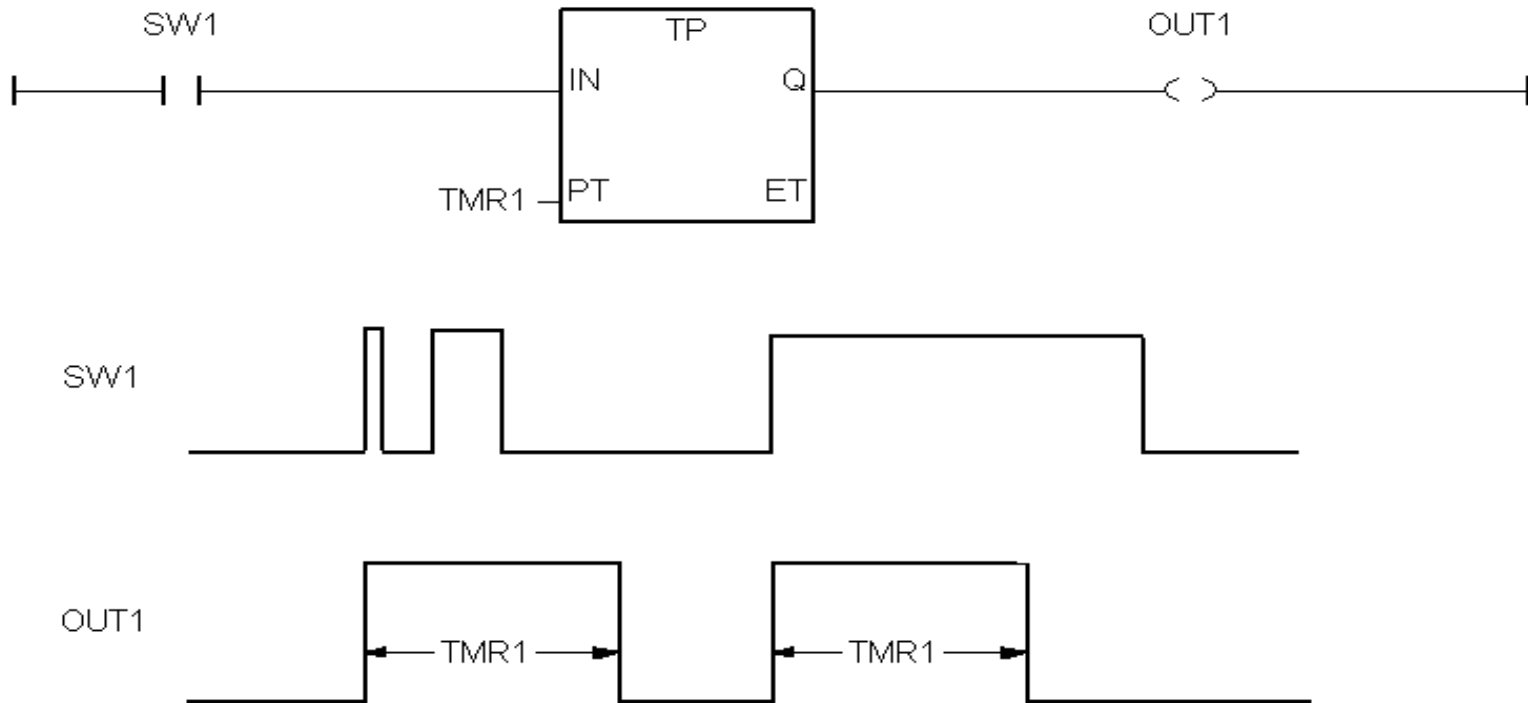
Blocks in LD

- Block can be linked with contact and coil
- Increase the function of LD program.



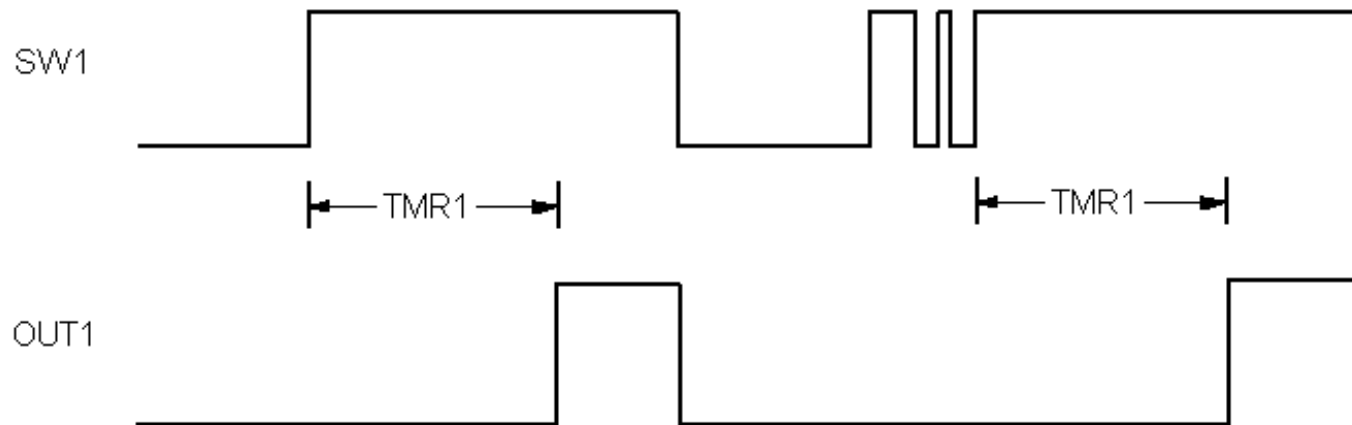
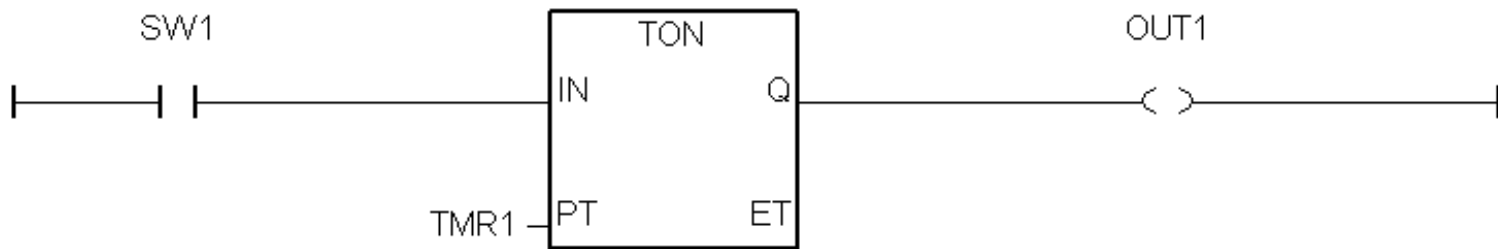
Timer Control : TP

Output a fixed period of time



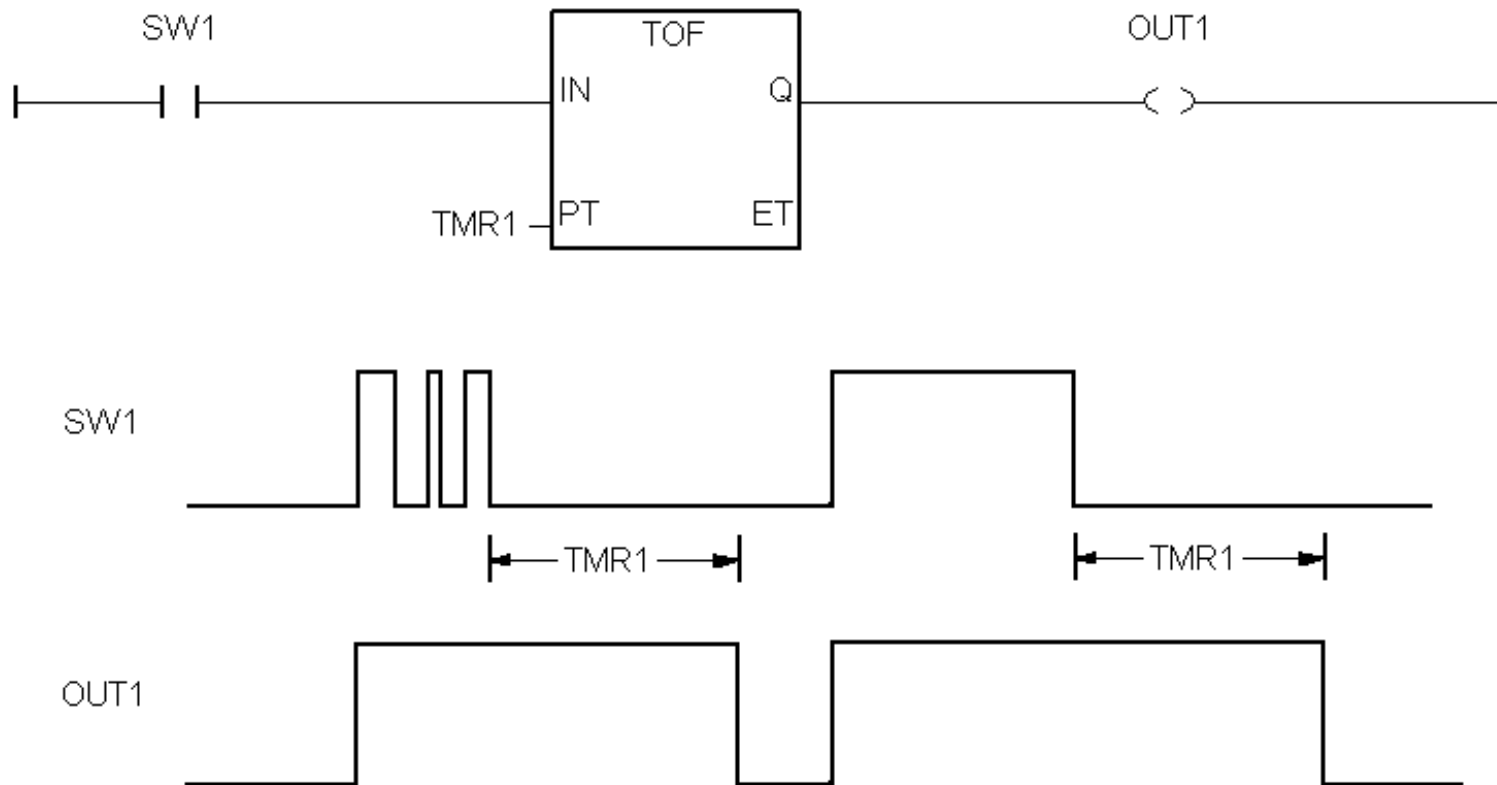
Timer Control : TON

Detect the stable ON (or Delay ON)

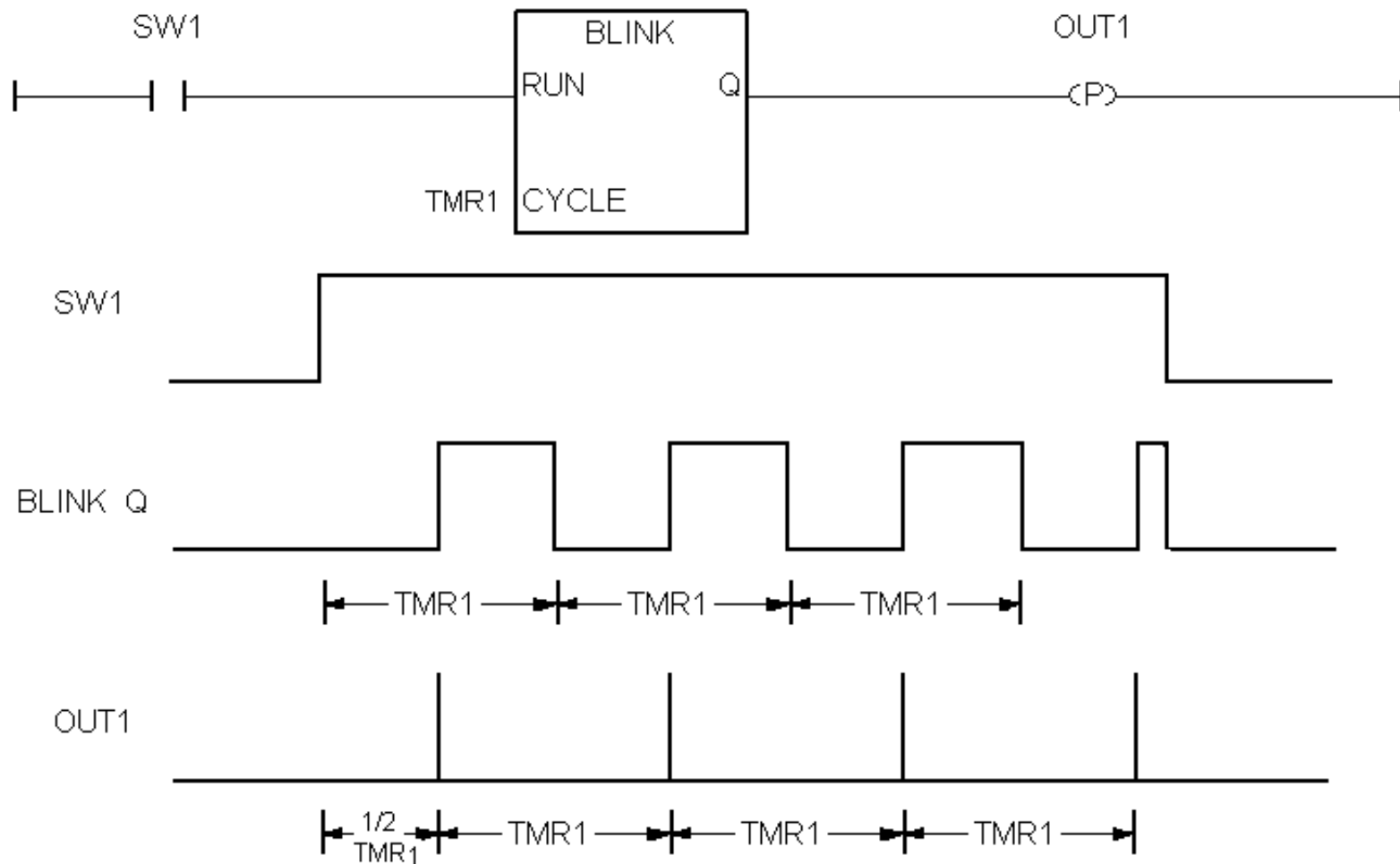


Timer Control : TOF

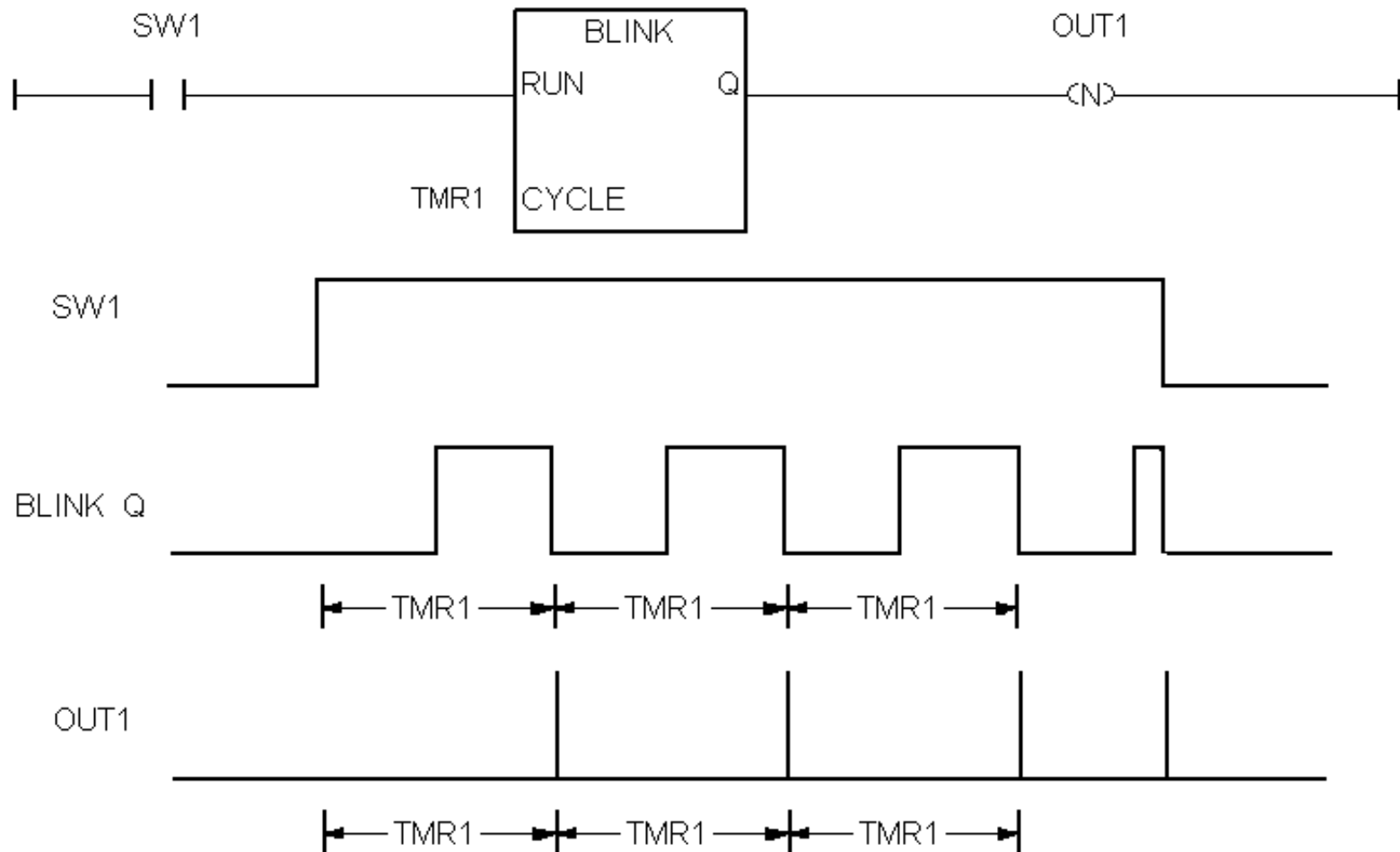
Detect the stable OFF (or Delay OFF)



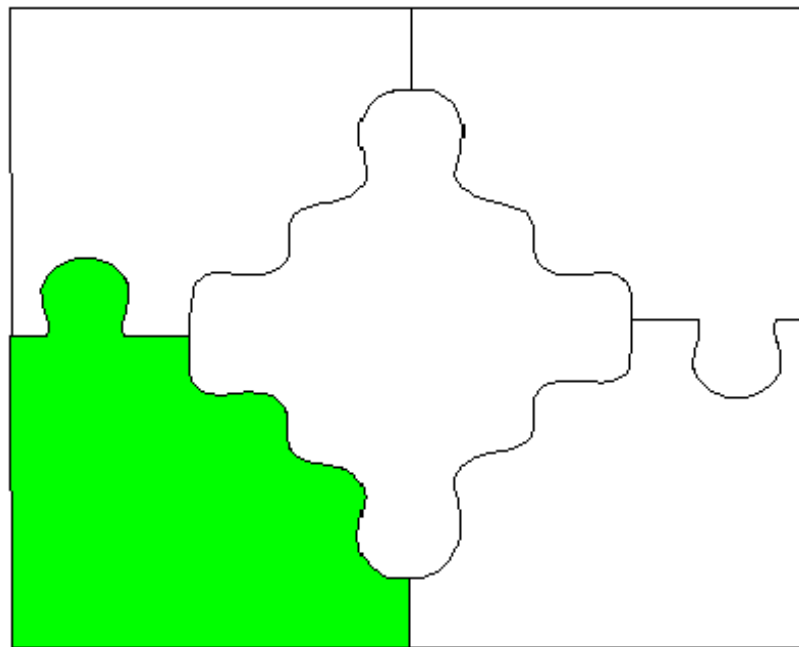
Timer Control : Pulse generator 1



Timer Control : Pulse generator 2



ST Language



Comment

(* This is a comment , Feb.08, 2006 *)

;

(* Every ST statement must end with a ; *)

A := B*3 + 8 ;

IF A > 100 Then

 TMP := ComStr_w(3,'A>100') ;

End_if ;

IF ... Then ... End_IF ;

If (A > 100) and (M1=False) Then

Count := Count + 1;

M1 := True;

End_if ;

IF ... Then ... Else ... End_IF ;

If M1 Then

Count := Count + 1;

Else

Count := Count -1 ;

End_if ;

IF ... Then ... ElseIf Then ...

If A < 10 Then

Count := Count + 1;

ElseIf A < 20 Then

Count := Count + 2 ;

Else

Count := Count + 3 ;

End_if ;

For ... End_For ;

For ii := 1 to 10 Do

A := A + 1;

R1 := R2 +3.2 ;

End_For ;

Call Function

Variable name := Function name(para1,para2, ...) ;

TMP := ComOpen(2, 9600, 8, 0, 1) ;

Str1 := Real_Str2(R1, 2) ;

Timer Operation : 1

tStart(T1) ; (* start ticking a timer “T1” *)

tStop(T1) ; (* Stop ticking “T1” *)

T1 := T#0s ; (* Reset as 0 *)

Timer Operation : 2

(* start timer to tick *)	(* stop ticking timer *)
if To_start then	if To_stop then
tStart(TMR1) ;	tStop(TMR1) ;
To_start := False ;	To_stop := False ;
End_if ;	End_if ;

Timer Operation : 3

(* Test timer condition and Reset timer *)

if TMR1 < T#10s then

(* do ... *)

Elsif TMR1 >= T#15 then

(* do ... *)

TMR1 := T#0s ;

End_if ;

The End Thank You !

Please refer to more information from “ISaGRAF User’s Manual”

**It can be download at www.icpdas.com > products > ISaGRAF
“ISaGRAF User’s Manual (English or Chinese)”**

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